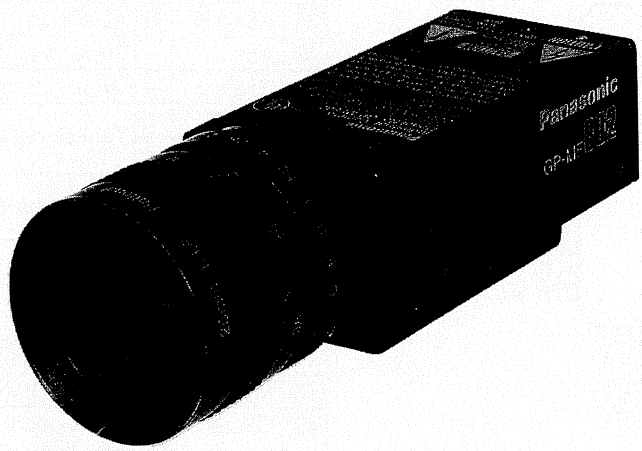
ORDER NO. AVS9705028C1
D0

Service Manual

Industrial Camera

GP-MF802



Camera Cable : Option
Lens : Option

SPECIFICATIONS

Pick-up Device :	Progressive Scanning Interline Transfer CCD with 659 (H) x 494 (V) pixels.
Image Size :	1/3" (6.3 (H) x 6.4 (V) mm)
	2 : 1 interlace 1-line interlace (Frame accumulation)
	2 : 1 interlace 2-line interlace (Field accumulation)
	2-line sequential (at non-interlaced external HD/VD)
Synchronization :	internal or external (Selectable automatically)
	Internal : Built-in sync generator
	External : 4.0 V[p-p] / 75 Ω Horizontal drive and vertical drive pulses for 2 : 1 interlace or sequential scanning
External Reset :	External signal (4.0 V[p-p]/75 Ω, negative) supplied to EXT VD IN connector can be used as reset signal
Horizontal Resolution :	480 lines at center
Minimum Illumination :	6.5 lx (0.65 footcandles) at F1.4, (Manual Gain Max, γ ON, 2 : 1 interlace, without shutter)
Signal to Noise Ratio :	56 dB Typical (Fix Gain, γ OFF, 2:1 interlace without shutter)
Electronic Shutter :	7-step (1/100 to 1/8,000) at normal.
	4-step (1/2,000 to 1/16,000) at Shutter Trigger-A.
	Approx. 1/2,000 at Shutter Trigger-B.
Lens Mount :	C-mount
Vibration Resistance :	8 G (10 Hz - 150 Hz), (2 hours each for three axes)(IEC 68)
Shock Resistance :	80 G (IEC 68) *IEC=International Electrotechnical Commission
Power Source :	12V DC, 190 mA
Ambient Temperature :	–10°C - +50°C (14°F - 122°F)

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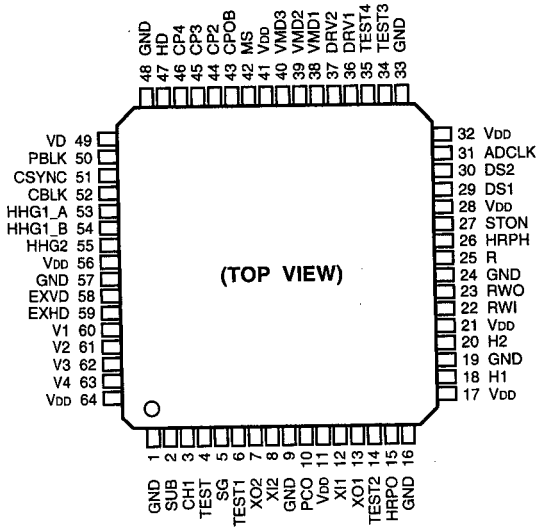
CIRCUIT DESCRIPTION

IC Description

1. Drive Board

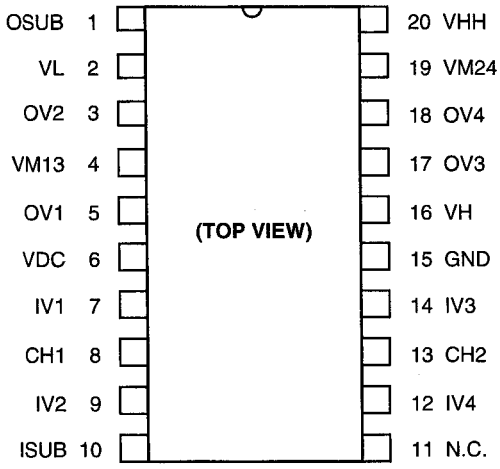
1.1. IC5 on the Drive Board is using the CCD Drive Pulse Generator IC YWBU121070A.

Description of this IC is as follows:



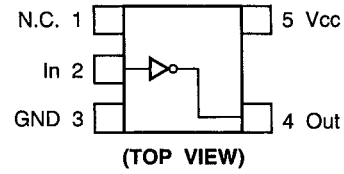
Pin	Name	I/O	Description
1	GND	–	Ground terminal.
2	SUB	O	Electronic Shutter Pulse output terminal.
3	CH1	O	Charge Pulse output terminal for ΦV1.
4	TEST	I	Test mode switching terminal.
5	SG	O	Sensor Gate Pulse output terminal.
6	TEST1	I	Test signal input terminal.
7	XO2	O	Crystal Oscillator 2 connecting terminals.
8	XI2	I	
9	GND	–	Ground terminal.
10	PCO	O	Phase Comparator output terminal.
11	VDD	–	Power supply terminal.
12	XI1	I	Crystal Oscillator 1 connecting terminals.
13	XO1	O	
14	TEST2	I	Test signal input terminal.
15	HRPO	I	HRPO signal input terminal.
16	GND	–	Ground terminal.
17	VDD	–	Power supply terminal.
18	H1	O	ΦH1 Transfer Pulse output terminal.
19	GND	–	Ground terminal.
20	H2	O	ΦH2 Transfer Pulse output terminal.
21	VDD	–	Power supply terminal.
22	RWI	I	Reset Pulse Width Adjust signal input terminal.
23	RWO	O	Reset Pulse Width Adjust signal output terminal.
24	GND	–	Ground terminal.
25	R	O	Reset Pulse output terminal.
26	HRPH	I	HRPH signal input terminal.
27	STON	I	STON signal input terminal.
28	VDD	–	Power supply terminal.
29	DS1	O	CDS Sample Hold Pulse output terminals.
30	DS2	O	
31	ADCLK	O	AD Clock Pulse output terminal.
32	VDD	–	Power supply terminal.
33	GND	–	Ground terminal.
34	TEST3	I	Test signal input terminals.
35	TEST4	I	
36	DRV1	I	DRV signal input terminals.
37	DRV2	I	
38	VMD1	I	VMD signal input terminals.
39	VMD2	I	
40	VMD3	I	
41	VDD	–	Power supply terminal.
42	MS	I	MS signal input terminal.
43	CPOB	O	OB (Optical Black) Clamp Pulse output terminal.
44	CP2	O	Clamp Pulse output terminals.
45	CP3	O	
46	CP4	O	
47	HD	O	Horizontal Drive signal output terminal.
48	GND	–	Ground terminal.
49	VD	O	Vertical Drive signal output terminal.
50	PBLK	O	Pre Blanking Pulse output terminal.
51	CSYNC	O	Composite Sync signal output terminal.
52	CBLK	O	Composite Blanking Pulse output terminal.
53	HHG1_A	O	HHG1_A signal output terminal.
54	HHG1_B	O	HHG1_B signal output terminal.
55	HHG2	O	HHG2 signal output terminal.
56	VDD	–	Power supply terminal.
57	GND	–	Ground terminal.
58	EXVD	I	External VD signal input terminal.
59	EXHD	I	External HD signal input terminal.
60	V1	O	ΦV1 Transfer Pulse output terminal.
61	V2	O	ΦV2 Transfer Pulse output terminal.
62	V3	O	ΦV3 Transfer Pulse output terminal.
63	V4	O	ΦV4 Transfer Pulse output terminal.
64	VDD	–	Power supply terminal.

1.2. IC6 on the Drive Board is using the CCD Vertical Driver IC MN3112SA.
Description of this IC is as follows:



Pin	Name	I/O	Description
1	OSUB	O	VSUB signal output terminal.
2	VL	–	VL voltage supply terminal.
3	OV2	O	Vertical Pulse 2 output terminal.
4	VM13	I	VM13 voltage supply terminal.
5	OV1	O	Vertical Pulse 1 output terminal.
6	VDC	–	Power supply.
7	IV1	I	Vertical Pulse 1 input terminal.
8	CH1	I	Horizontal Pulse 1 input terminal.
9	IV2	I	Vertical Pulse 2 input terminal.
10	ISUB	I	VSUB signal input terminal.
11	N.C.	–	Non Connection.
12	IV4	I	Vertical Pulse 4 input terminal.
13	CH2	I	Horizontal Pulse 2 input terminal.
14	IV3	I	Vertical Pulse 3 input terminal.
15	GND	–	Ground terminal.
16	VH	–	VH voltage supply terminal.
17	OV3	O	Vertical Pulse 3 output terminal.
18	OV4	O	Vertical Pulse 4 output terminal.
19	VM24	–	VM24 voltage supply terminal.
20	VHH	–	VHH voltage supply terminal.

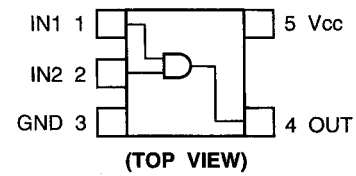
1.3. IC12 and IC13 on the Drive Board and IC8 on the Power Board are using the Single Inverter IC YWTC7S04FUL.
Description of this IC is as follows:



Truth Table

Input	Output
L	H
H	L

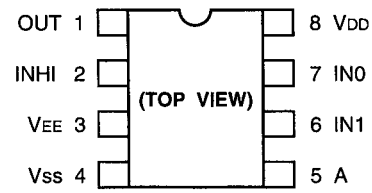
1.4. IC8 on the Drive Board and IC9 on the Power Board are using the Single 2-Input AND Gate IC YWTC7S 08FUL.
Description of this IC is as follows:



Truth Table

Inputs		Output
IN1	IN2	
L	L	L
H	L	L
L	H	L
H	H	H

1.5. IC10 on the Drive Board is using the Single 2-Channel Multiplexer/Demultiplexer IC YWTC4W53FUL.
Description of this IC is as follows:

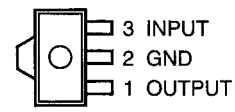


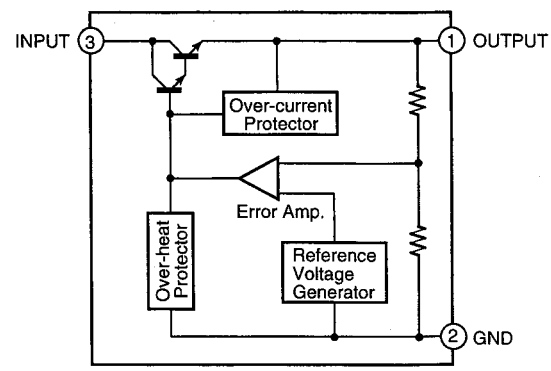
Truth Table

INPUTS		OUT
INHI	A	
L	L	IN0
L	H	IN1
H	*	None

*: Don't Care.

1.6. IC7 on the Drive Board is using the Three-Terminal 9V Voltage Regulator IC YW78L09UATE2.
Description of this IC is as follows:





ADJUSTMENT PROCEDURE

1. Test Equipments Required

- The following equipments are required for adjustment of the Industrial Camera GP-MF802.

- Oscilloscope
- Digital Voltmeter
- Camera Cable (GP-CA81, GP-CA82 or GP-CA83)
- Manual Iris Lens
- DC Power Supply Unit
- Underscanned Black & White Video Monitor
- HD/VD Signal Generator or Special Effects Generator
- Lighting (2,750 ± 150 lx (1,050 ± 50 nt))
- 40-watt Lamp
- Illuminometer
- Logarithmic Gray Scale Chart (Part No. : YWV2310RB99) as shown in Fig. 1-1.

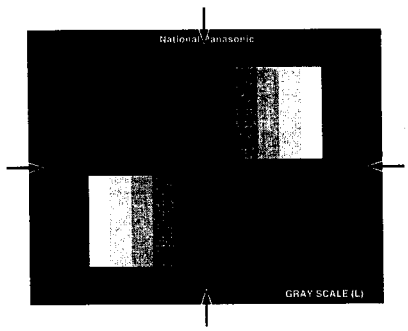


Fig. 1-1

2. Disassembling Procedures for Adjustment

- Referring to Fig. 2-1, remove six screws that secure the Upper Cover and remove the Upper Cover.

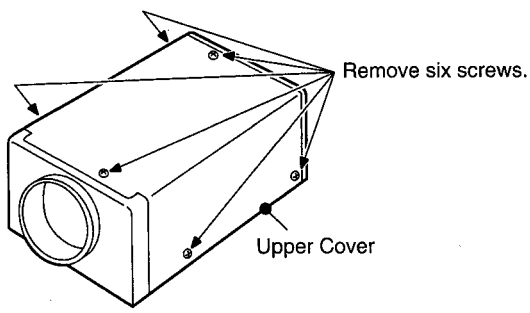


Fig. 2-1

- Referring to Fig. 2-2, remove two screws that secure the Drive Board and remove the Drive Board.

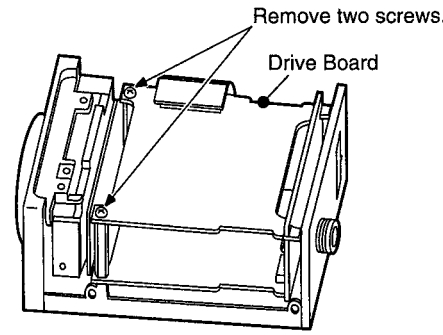
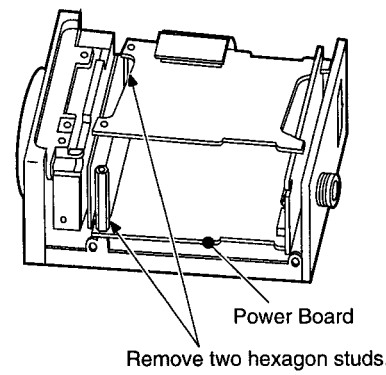


Fig. 2-2

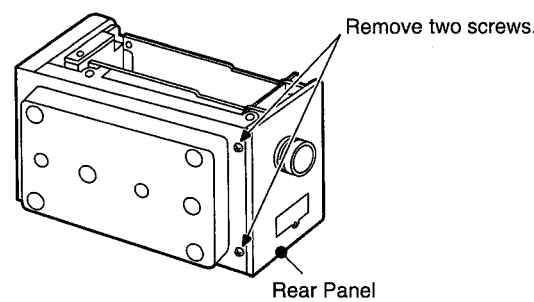
- Referring to Fig. 2-3, remove two hexagon studs that secure the Power Board and remove the Power Board.

Fig. 2-3



- Referring to Fig. 2-4, remove two screws that secure the Rear Panel and remove the Rear Panel.

Fig. 2-4



3. Replacement Procedures of the Head Optical Ass'y

- Referring to the item **2. Disassembling Procedures for Adjustment**, remove both the Drive Board and Power Board.
- Referring to Fig. 3-1, remove two screws that secure the Head Optical Ass'y and remove the Head Optical Ass'y.

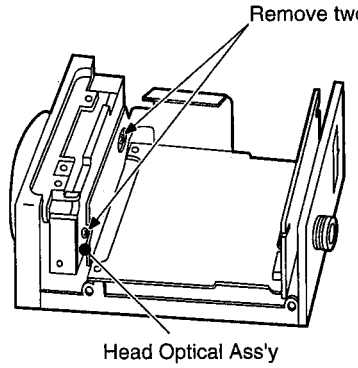


Fig. 3-1

4. Connection and Setting Up for Adjustment

4.1. Connection

- The Fig. 4-1 shows the connecting diagram for the adjustment procedure.

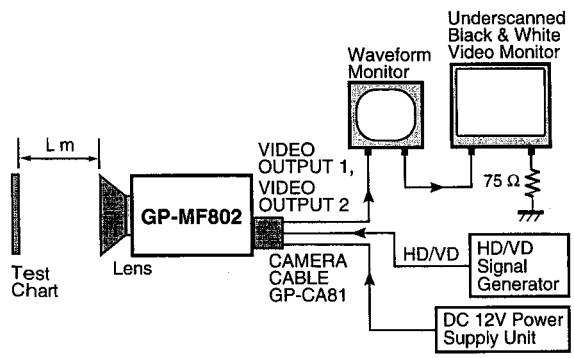


Fig. 4-1

- Connect the Camera Cable GP-CA81 to the Camera Cable Connector on the Rear Panel of the GP-MF802.
- Connect the Underscanned Black and White Video Monitor to the Video Output Connector of the Camera Cable GP-CA81.
- Terminate the input terminal of the Underscanned Black and White Video Monitor with 75Ω.
- Connect the DC 12V Power Supply Unit to the DC 12V Input Cable of the Camera Cable GP-CA81.

  Note: Refer to the pin arrangement of the Camera Cable described in the Cameras Cable Connector on the page 1.
- Connect the HD/VD Signal Generator to the HD signal Input Cable and the VD signal Input Cable of the Camera Cable GP-CA81.
- Connect the prove of the Digital Voltmeter or Oscilloscope to the desired Test Point in each adjustment step.

4.2. Setting Up of Switches for Adjustment

- Referring to the Item **3. Switch Cover Removal** of the **PREPARATIONS** in the page 3, remove the Switch Cover.
- Set the Switches on the Rear Panel of the GP-MF802 as follows:

SW1 (Mode 1)	OFF position
SW2 (Mode 2)	OFF position
SW3 (Shutter Trigger)	OFF position
SW4 (Shutter Speed D0)	OFF position
SW5 (Shutter Speed D1)	OFF position
SW6 (Shutter Speed D2)	OFF position
SW7 (HD Termination)	ON position
SW8 (VD Termination)	ON position
SW9 (Long Time Exposure Mode) . . .	OFF position
SW10 (Clock Out)	OFF position

- The adjustment should be done with this Setting unless otherwise specified.

4.3. Setting Up for Standard Picture

- Mount the Manual Iris Lens (HF16A) on the Camera.
- Set the Logarithmic Gray Scale Chart.
- Incident light of 1,050 ± 50 nt (2,750 ± 150 lx) on the Logarithmic Gray Scale Chart.
- Aim the Camera at the Logarithmic Gray Scale Chart.
- Mount the ND8 Filter on the Lens.
- Set the Camera so that the Logarithmic Gray Scale Chart becomes full picture on the Underscanned Black and White Video Monitor.

- Connect the Oscilloscope to TP1 on the Sensor Board.
- Adjust the Lens Iris so that the CCD output signal at TP1 becomes 214 mV as shown in Fig. 4-2.

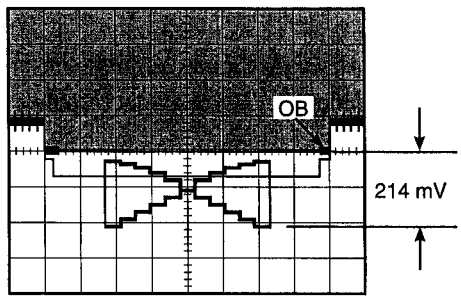


Fig. 4-2

- The adjustment should be done with this Standard Picture unless otherwise specified.

5. Adjustment Procedure

- Refer to the Location of the Test Points and Adjusting Controls on page 15.

(1). PLL VCO Adjustment

Test Point:	**TP4 (VCO)**	**Drive Board**
Adjust:	**L1 (VCO)**	**Drive Board**

- Supply the HD signal and the VD signal from the Camera Cable Connector.
- Connect the Digital Voltmeter to TP4.
- Adjust L1 to obtain 2.2 ± 0.2 V DC.

(2). Reset Bias Adjustment

Test Point:	**TP1 (CCD OUT 1)**	**Sensor Board**
	TP1 (R-BIAS)	**Drive Board**
Adjust:	**VR1 (R-BIAS)**	**Drive Board**

- Aim the Camera at the Logarithmic Gray Scale Chart.
- Connect the Oscilloscope to TP1 on the Sensor Board.
- Trigger the Oscilloscope at the H-rate.
- Adjust VR1 so that the Reset Noise becomes maximum as shown in Fig. 5-1.

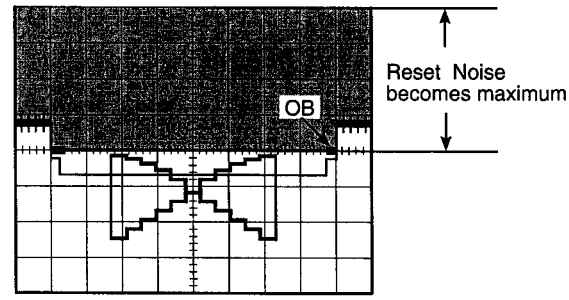


Fig. 5-1

- Connect the Oscilloscope to TP1 on the Drive Board.
- Adjust VR1 so that the Reset Bias becomes 5.0 ± 0.5 V as shown in Fig. 5-2.

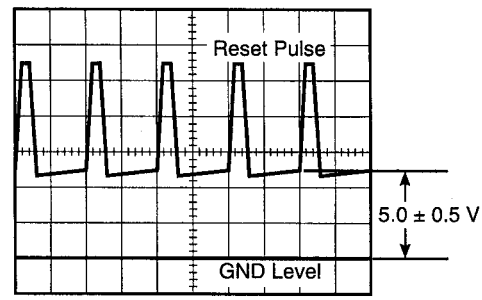


Fig. 5-2

(3). VSUB Coarse Adjustment

Test Point:	**TP1 (CCD OUT 1)**	**Sensor Board**
	TP2 (CCD OUT 2)	**Sensor Board**
Adjust:	**VR6 (Vsub1)**	**Drive Board**
	VR7 (Vsub2)	**Drive Board**
Observe	**Video Monitor**	

- Set the Bright Control of the Video Monitor to the mechanical center position.
- Set the Contrast Control of the Video Monitor to the mechanical center position.
- Set the Lens Iris to F8.
- Turn VR7 to obtain noise on the Video Monitor, and adjust VR7 so that the noise just disappears as shown in Fig. 5-3.
- Set the Switch 1 to ON position, and confirm that the no noise appears on the Video Monitor.
- Set the Switch 1 to OFF position.
- Set the Lens Iris to F11.
- Set the Switch 2 to ON position.

- Turn VR6 to obtain noise on the Video Monitor, and adjust VR6 so that the noise just disappears as shown in Fig. 5-3.

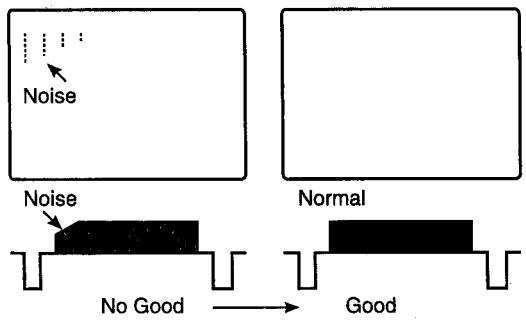


Fig. 5-3

- Set the Switch 2 to OFF position.
- Aim the Camera at the Logarithmic Gray Scale Chart.
- Connect the Oscilloscope to TP1 on the Sensor Board.
- Open the Lens Iris so that only 11th portion of the CCD OUT signal saturates, and confirm that the saturated signal level is more than 400 mV as shown in Fig. 5-4.
- Change the connection of the Oscilloscope to TP2 on the Sensor Board.
- Confirm that the saturated signal level is more than 400 mV as shown in Fig. 5-4, if not satisfied readjust VR7.
- Set the Switch 1 to ON position.
- Confirm that the saturated signal level is more than 400 mV as shown in Fig. 5-4.
- Set the Switch 1 to OFF position.
- Set the Switch 2 to ON position.
- Connect the Oscilloscope to TP1 on the Sensor Board.
- Open the Lens Iris so that only 11th portion of the CCD OUT signal saturates, and confirm that the saturated signal level is more than 400 mV as shown in Fig. 5-4, if not readjust VR6.

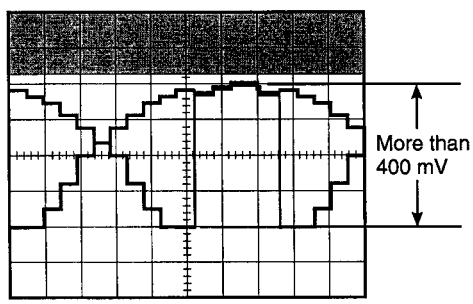


Fig. 5-4

(4). Pedestal-1 and Video Gain-1 Adjustment

Test Point: **Video 1**

Adjust: **VR2 (GAIN 1)** **Drive Board**

VR3 (PED 1) **Drive Board**

- Cap on the Lens.
- Connect the terminated Oscilloscope with 75Ω to Video 1 of the Camera Cable.
- Set the Switch 1 and Switch 2 to OFF position.
- Adjust VR3 so that the Pedestal signal level becomes 50 ± 10 mV as shown in Fig. 5-5.

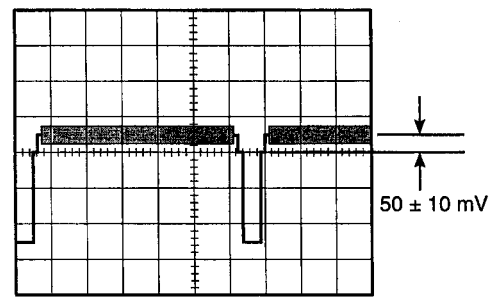


Fig. 5-5

- Remove the Cap from the Lens, and connect the Oscilloscope to TP1 on the Sensor Board.
- Adjust the Lens Iris so that the CCD output signal at TP1 becomes 214 mV.
- Adjust VR2 so that the Video signal level becomes 100 IRE (714 mV) as shown in Fig.5-6, and confirm that the Sync signal level is 40 ± 4.2 IRE (286 ± 30 mV) as shown in Fig. 5-6.

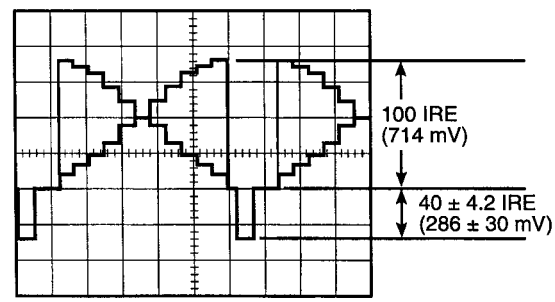


Fig. 5-6

- Set the Switch 1 to ON position.
- Confirm that both Pedestal signal level and Video signal level are within specification.
- Set the Switch 1 to OFF position.

(5). Pedestal-2 and Video Gain-2 Adjustment

Test Point: **Video 2**

Adjust: **VR4 (PED 2)** **Drive Board**

VR5 (GAIN 2) **Drive Board**

- Aim the Camera at the Logarithmic Gray Scale Chart.

- Connect the terminated Oscilloscope with 75Ω to Video 2 of the Camera Cable.
- Set the Switch 1 and Switch 2 to OFF position.
- Adjust VR4 so that the Pedestal signal level becomes same as that of the Video 1 as shown in Fig. 5-7.

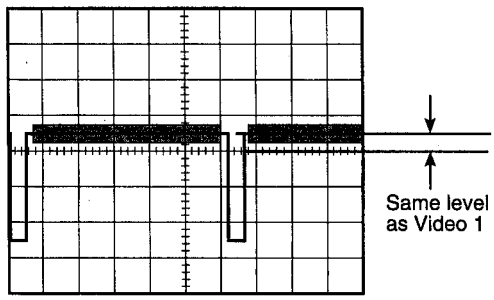


Fig. 5-7

- Remove the Cap from the Lens, and connect the Oscilloscope to TP1 on the Sensor Board.
- Adjust the Lens Iris so that the CCD output signal at TP1 becomes 214 mV.
- Adjust VR5 so that the Video signal level becomes 100 IRE (714 mV) as shown in Fig.5-8, and confirm that the Sync signal level is 40 ± 4.2 IRE (286 ± 30 mV) as shown in Fig. 5-8.

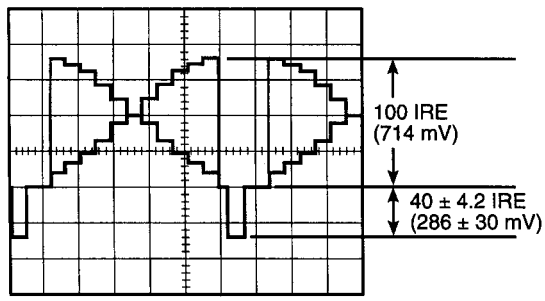


Fig. 5-8

- Set the Switch 1 to ON position.
- Confirm that both Pedestal signal level and Video signal level are within specification.
- Set the Switch 1 to OFF position.

(6). VSUB Fine Adjustment

Adjust: **VR6 (Vsub1)** **Drive Board**
VR7 (Vsub2) **Drive Board**
Observe **Video Monitor**

- Aim the Camera at the 40-watt Lamp placed in the dark background.
- Set the Lens Iris fully open (F1.4).
- If the blooming and noise appear on the Video Monitor as shown in Fig. 5-9, readjust VR7.

Notes: VR7 should be adjusted to the point where the blooming just eliminates.
Do not turn VR7 too much.
If readjust VR7, must be readjusted from the adjustment steps (3) through (5).

- Set the Switch 1 to ON position, and confirm that the no blooming appears on the Video Monitor.
- Set the Switch 1 to OFF position.
- Set the Switch 2 to ON position.
- If the blooming and noise appear on the Video Monitor as shown in Fig. 5-9, readjust VR6.

Notes: VR6 should be adjusted to the point where the blooming just eliminates.
Do not turn VR6 too much.
If readjust VR6, must be readjusted from the adjustment steps (3) through (5).

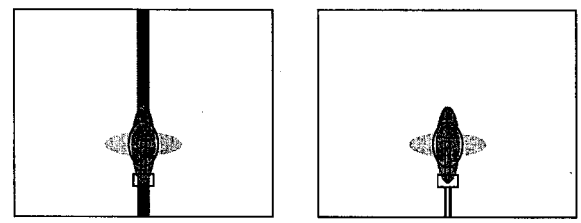
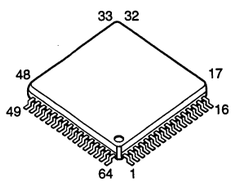


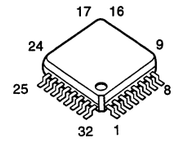
Fig. 5-9

APPEARANCE OF ICs, TRANSISTORs AND DIODEs

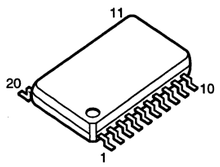
YWBU121070A



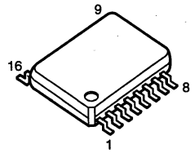
YWCXA1310AQ



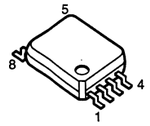
MN3112SA



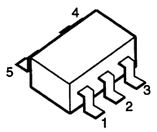
YWMB3775PFV



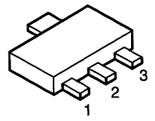
YWTC4W53FUL



YWTC7S04FUL
YWTC7S08FUL

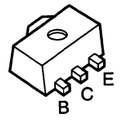


YW78L09UATE2

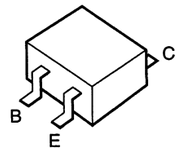


1. Out
2. GND
3. In

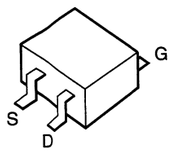
2SB766A-QR
2SD874A-RS



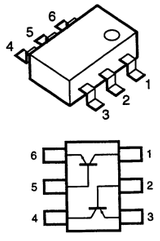
2SA1774
2SC4617



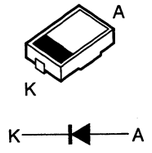
2SK662-PQR



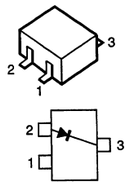
UMZ1



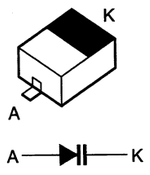
YWSC2114L
YWSC80206L



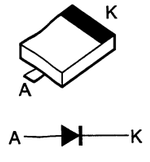
MA132K



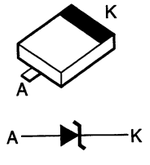
MA372



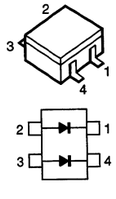
MA729



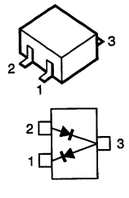
YWMA8024TX



YWDA227TL

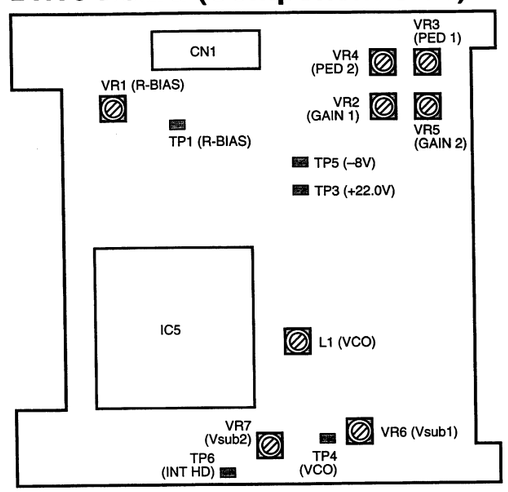


YWDA223TL

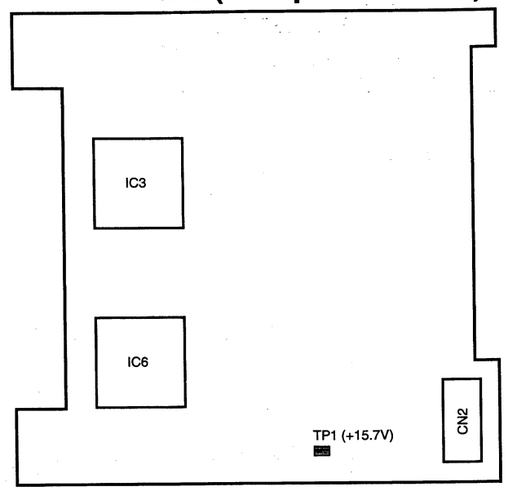


LOCATION OF TEST POINTS AND ADJUSTING CONTROLS

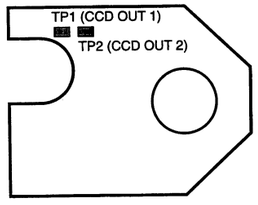
Drive Board (Component Side)



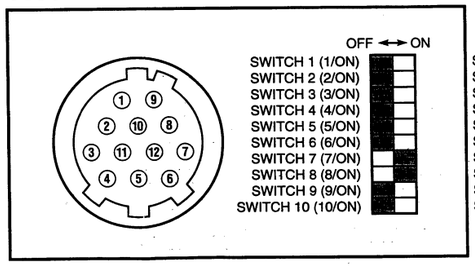
Power Board (Component Side)



Sensor Board (Component Side)



Rear Panel



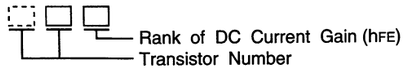
SWITCH 1 (Mode 1)
SWITCH 2 (Mode 2)
SWITCH 3 (Shutter Trigger)
SWITCH 4 (Shutter Speed D0)
SWITCH 5 (Shutter Speed D1)
SWITCH 6 (Shutter Speed D2)
SWITCH 7 (HD Termination)
SWITCH 8 (VD Termination)
SWITCH 9 (Long Time Exposure Mode)
SWITCH 10 (Clock Out)

1: GND
2: DC12V
3:GND (VIDEO 1)
4: VIDEO 1
5: GND (HD)
6: EXT HD
7: EXT VD
8: GND (VIDEO 2)
9: VIDEO 2
10: GND (CLOCK)
11: CLOCK OUT
12: GND (VD)

CHIP COMPONENTS

1. Chip Transistor

The transistor number is indicated on the top surface of the chip transistor using two alphabet letters or one numerical number and two alphabet letters.



Transistor Number

(Chip Transistor)

Letter	Transistor No.	Letter	Transistor No.
A	2SB709	X	2SD602A
B	2SB709A	Y	2SD601
C	2SB710	Z	2SD601A
D	2SB710A	1A	2SB799
E	2SA1022	1B	2SB814
F	2SA1034	1C	2SB902
H	2SA1035	1F	2SK321
I	2SB792	1K	2SK316
K	2SC2778	1L	2SK247
P	2SD814	1M	2SJ84
Q	2SD813	1N	2SK199
R	2SC2480	1O	2SK198
S	2SC2405	1T	2SC3077
T	2SC2406	1X	2SC2845
U	2SC2404	1Z	2SD1030
V	2SC2295	2B	2SK374
W	2SD602	2C	2SK116
BQ	2SB766A	UMT	2SC4081

(Small Chip Transistor) (Pair Transistor)

Letter	Transistor No.
A	2SB1218
B	2SB1218A
D	2SB1219A
U	2SC3931
W	2SD1820
X	2SD1820A
Y	2SD1819
E3	2SA1226
OS	2SB1219
UC	2SA1532
YU	2SC3938

Letter	Transistor No.	Letter	Transistor No.
5R	XN1501	5H	XP4501
7S	XN1601	5C	XP4601
5H	XN4501	5H	XP4501
5C	XN4601	5L	XP5501
5L	XN5501	4N	XP5601
4N	XN5601	7S	XP6501
5N	XN6501	7W	XP6435
7W	XN6435	7F	XP6534
7F	XN6534	X1	UMX1
5R	XP1501	Z1	UMZ1
7S	XP1601		

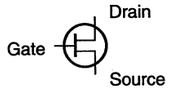
Example: WQ → 2SD602-Q
YQ → 2SD601-Q
1BS → 2SB814-S

Appearance and Symbols

Transistor

C: Collector
B: Base
E: Emitter

FET



	1	2	3
Eacept 2SK199	Drain	Source	Gate
2SK199	Gate	Drain	Source

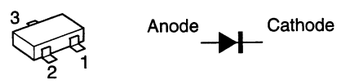
2. Chip Diode

The diode number is indicated on the top surface of the chip diode using two alphabet letters.

Diode Number

Letter	Diode No.	Letter	Diode No.
MA	MA151A	MI	MA152K
MB	MA152A	MK	MA28W-B
MC	MA153	ML	MA28T-A
MD	MA28-A	MN	MA151WA
ME	MA28-B	MO	MA152WA
MF	MA28W-A	MT	MA151WK
MH	MA151K	MU	MA152WK
MH	MA141K	6.2	MA3062
MC	MA143	SMD	RD421D

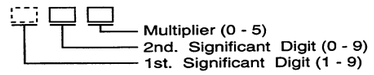
Appearance and Symbol



	1	2	3
MA28/MA28W/MA28T	–	Anode	Cathode
MA151K/MA152K	–	Anode	Cathode
MA151A/MA152A	–	Cathode	Anode
MA151WK/MA152WK	Anode	Anode	Cathode
MA151WA/MA152WA	Cathode	Cathode	Anode
MA153	Cathode	Anode	Common
MA141K	–	Anode	Cathode
MA143	Anode	Cathode	Common
MA3062	Anode	–	Cathode
RD421D	Anode	–	Cathode

3. Chip Resistor

The resistor value is indicated on the bottom surface of the chip resistor using three digit numbers.



Example:

330 → 33×10^0 = 33 Ω
561 → 56×10^1 = 560 Ω
123 → 12×10^3 = 12 kΩ

Note: Zero ohm resistor (jumper chip) is colored red or green.

4. Chip Capacitor

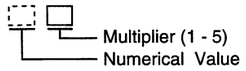
The capacitive value of replacement chip capacitors is indicated on the bottom surface. Original parts have no value indication.

If the capacitive value is less than 100 pF, the value will be indicated by one or two digit number expressing the capacity directly in pF.

Example:

0.5 → 0.5 pF 2.5 → 2.5 pF
.75 → 0.75 pF 33 → 33 pF
1 → 1 pF 82 → 82 pF

If the capacitive value is 100 pF or greater, the value will be indicated by an alpha-numeric code. The letter precedes the number and expresses a numerical value to be multiplied by the number which follows.



Numerical Value

Letter	Value	Letter	Value
A	10	N	33
B	11	P	36
C	12	Q	39
D	13	R	43
E	15	S	47
F	16	T	51
G	18	U	56
H	20	V	62
J	22	W	68
K	24	X	75
L	27	Y	82
M	30	Z	91

* Letters I and O are not used.

Example: A1 → 10×10^1 = 100 pF
N2 → 33×10^2 = 3300 pF
S3 → 47×10^3 = 47000 pF

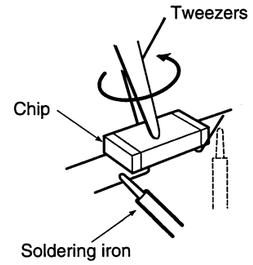
5. Precautions in replacing the chip component

1. Make sure that the unit is turned OFF when replacing the chip.
2. Use tweezers to prevent any damage to the chip surface.
3. Do not re-use the chips after removal.
4. Do not rub the electrode of chips.
5. Do not subject the chips to excessive stress.
6. It is recommended that a pencil-type soldering iron to be used.
7. The solder whose diameter is less than 0.5 mm is recommended.
8. Do not heat the chip more than 3 seconds.
9. Maintain temperature control under 260°C (500°F) when soldering.

5-1. Removal (Transistor, Diode, Resistor and Capacitor)

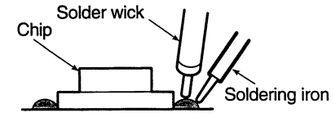
1. Add the solder to both ends of the chip (three leads for chip transistor).
2. While attaching the soldering iron to both ends of the chip (three leads for chip transistor) as shown below, remove the chip by turning with tweezers.

Note: Be careful not to damage other chips.

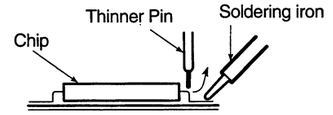


5-2. Removal (IC)

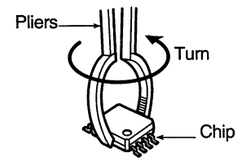
1. Add the solder wick and soldering iron to each lead of the IC and remove solder.



2. Add the soldering iron to each lead of the IC and left each lead of the IC using thinner pin.

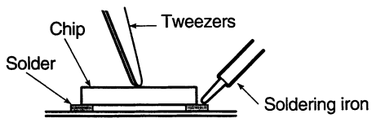


3. Remove the IC turning with pliers.

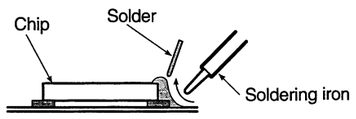


5-3. Mounting

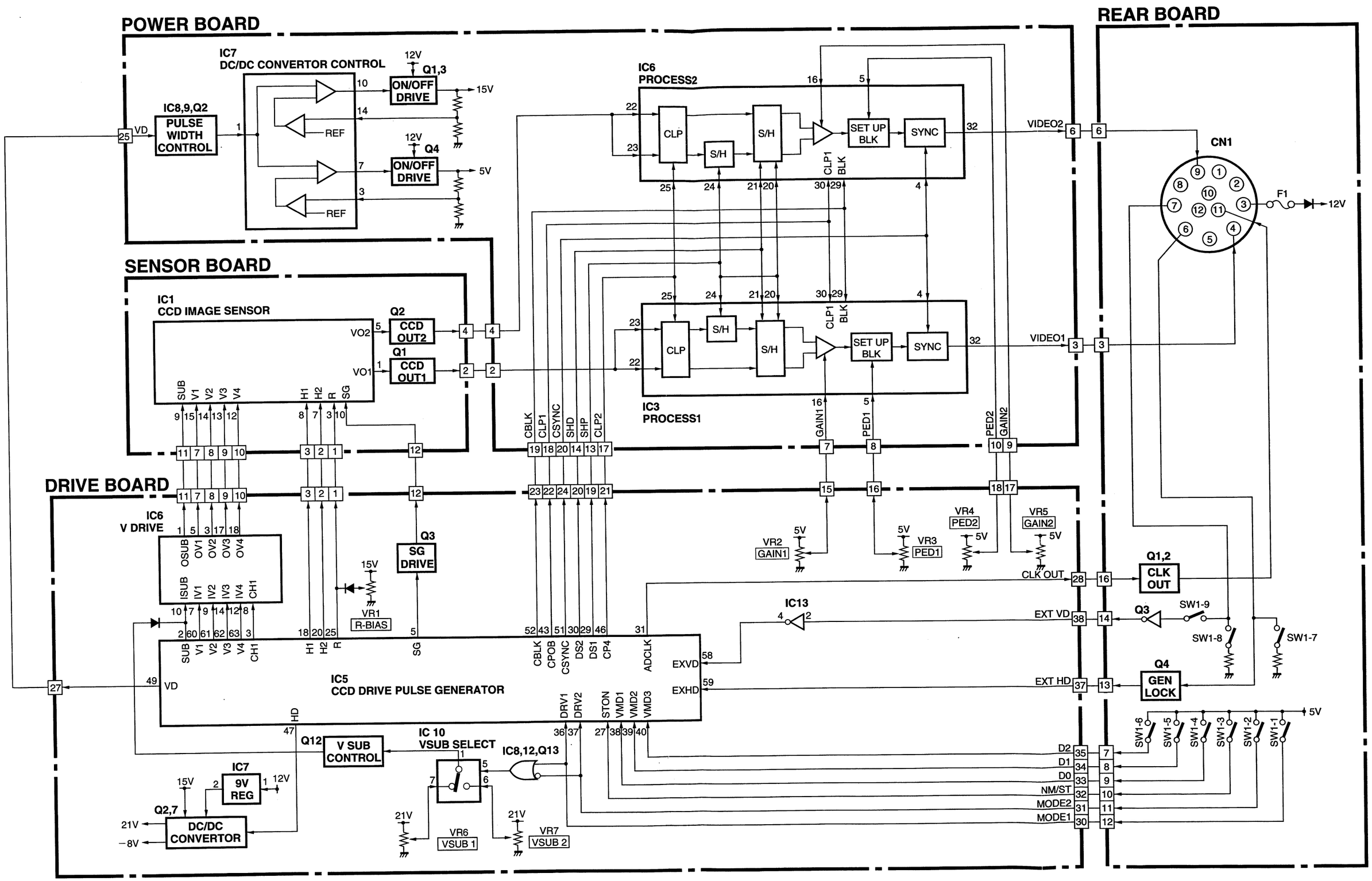
1. Place the solder thinly on the chip mounting foil.
2. Solder the chip temporarily while holding the chip with the tweezers.



3. Solder both ends of the chip (three leads for chip transistor).



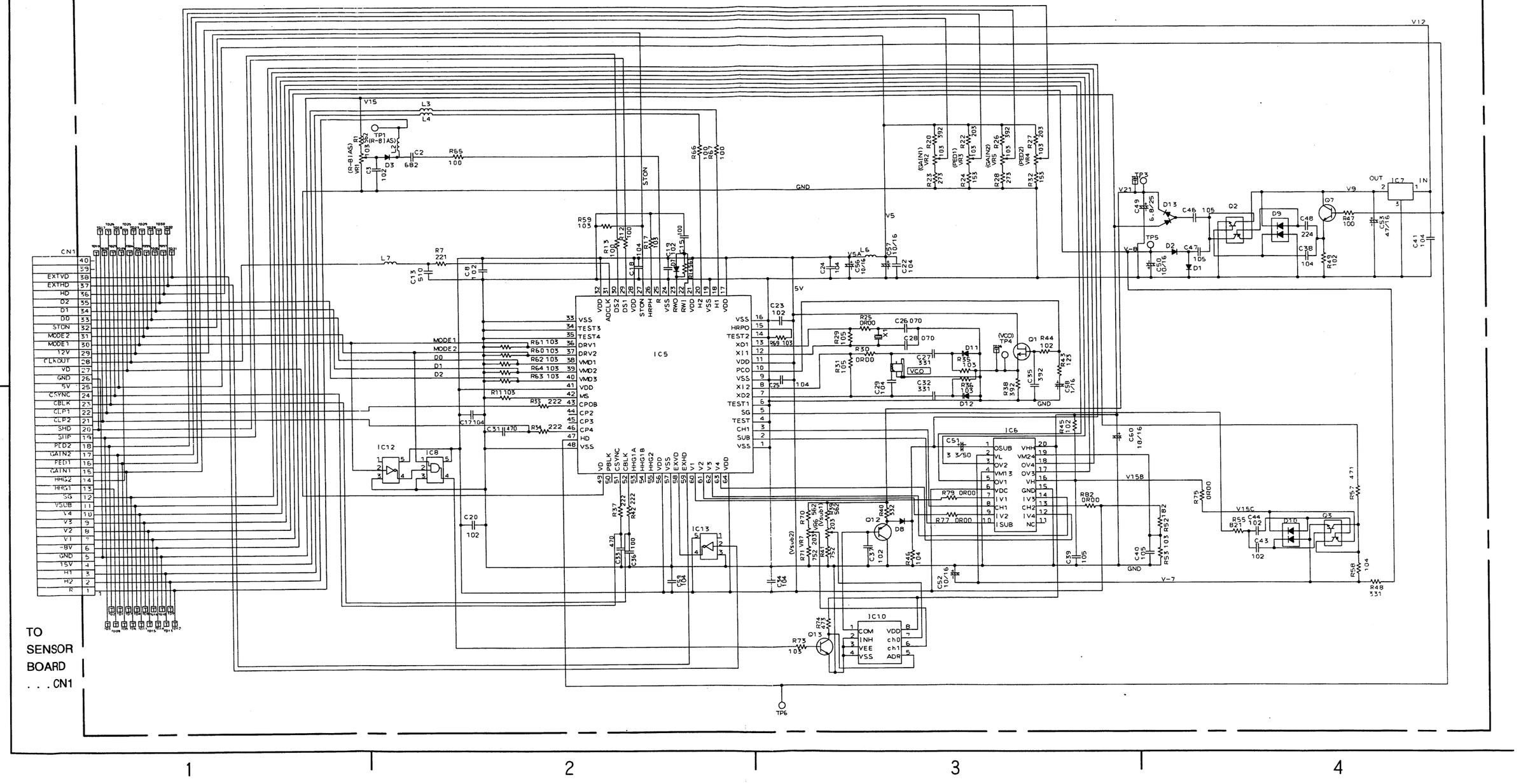
BLOCK DIAGRAM



VIDE-V27803 / DRUCK: 3

SCHEMATIC DIAGRAM OF DRIVE BOARD

DRIVE BOARD



<Index>

DRIVE BOARD

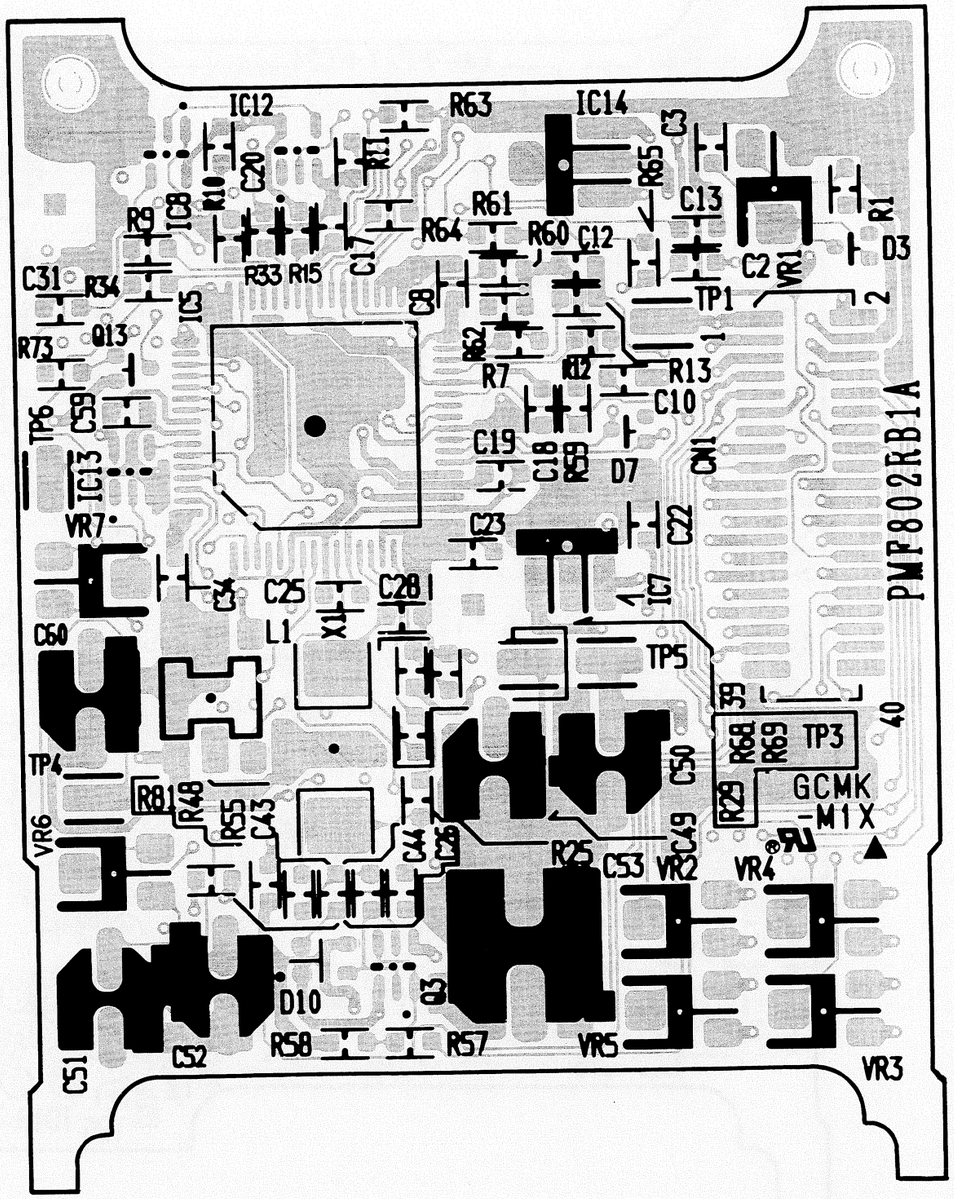
IC5	A2,B2	Q1	B3	D1	B4
IC6	A3	Q2	B4	D2	B4
IC7	B4	Q3	A4	D3	B2
IC8	A2	Q7	B4	D7	B2
IC10	A3	Q12	A3	D8	A3
IC12	A2	Q13	A3	D9	B4
IC13	A2			D10	A4
				D11	B3
				D12	A3
				D13	B4

VIDE-V27803 / DRUCK: 4

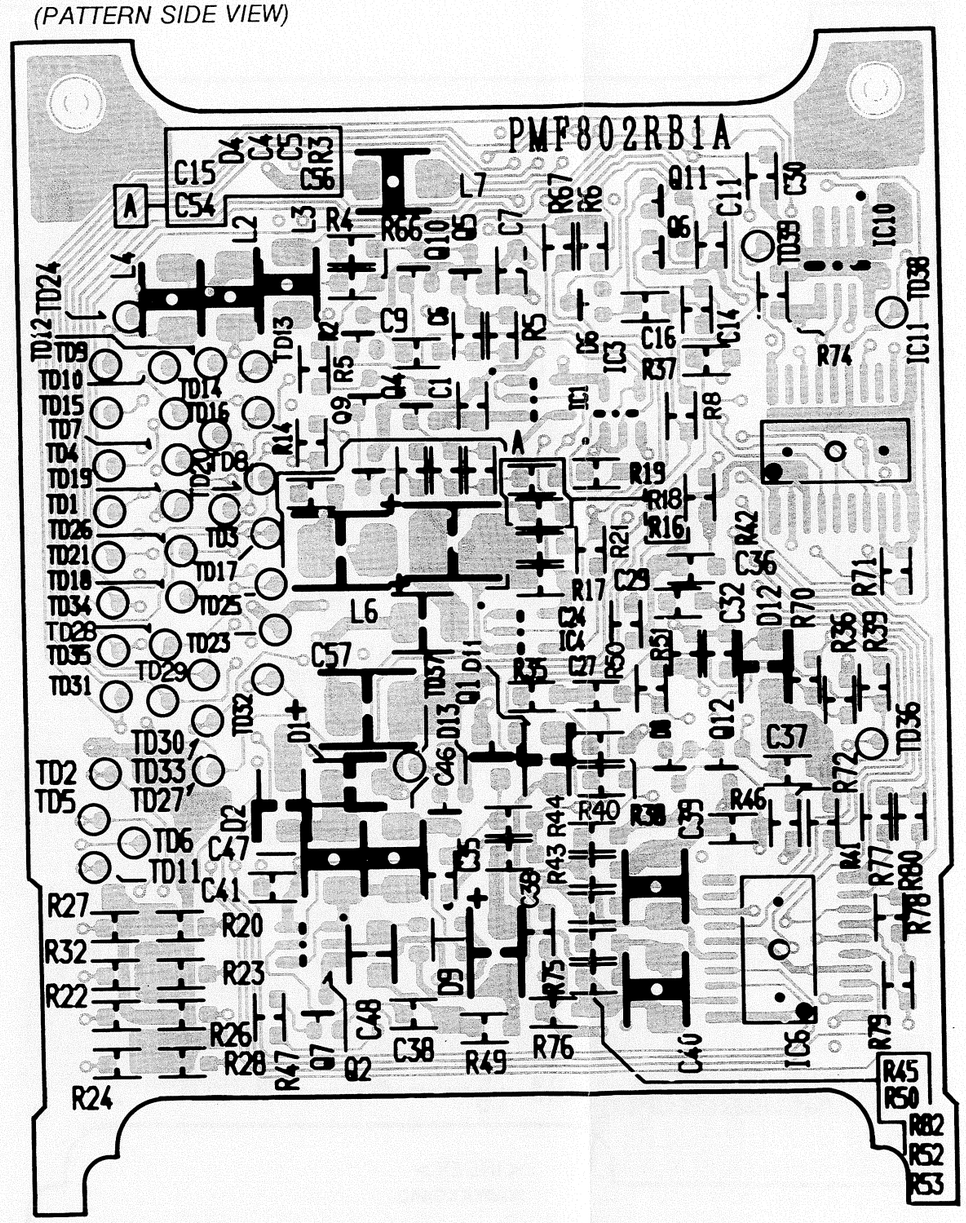
CONDUCTOR VIEW OF DRIVE BOARD

DRIVE BOARD

(COMPONENT SIDE VIEW)



(PATTERN SIDE VIEW)



<Index>

DRIVE BOARD

IC5	C2
IC6	A6
IC7	C3
IC8	D2
IC10	D6
IC12	D2
IC13	C1
Q1	B5
Q2	A5
Q3	A2
Q7	A5
Q12	B6
Q13	C1
D1	B5
D2	B5
D3	D4
D7	C3
D8	B6
D9	B5
D10	A2
D11	B5
D12	C6
D13	B5

COMPONENT SIDE
INTERMEDIATE PATTERN

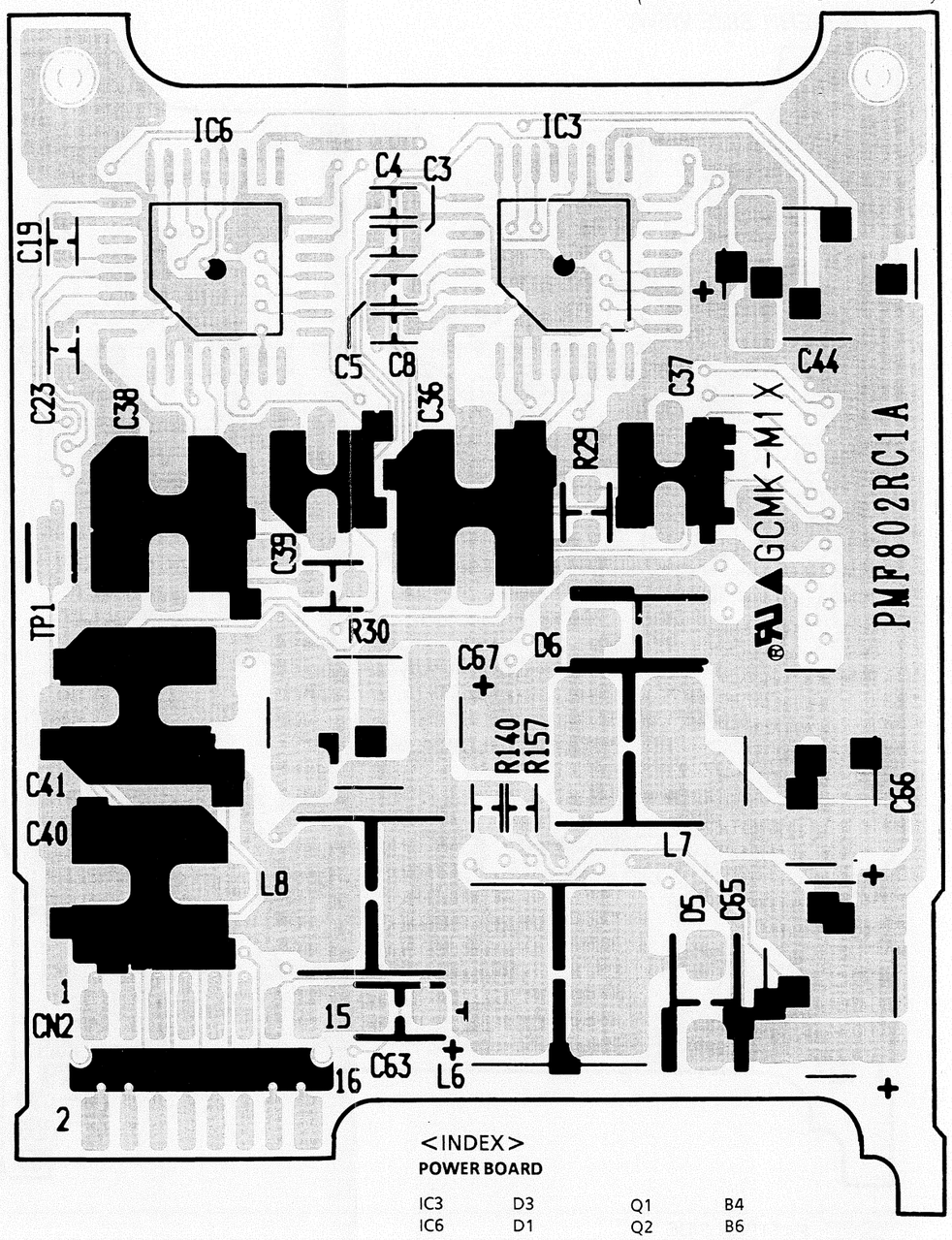
PATTERN SIDE
INTERMEDIATE PATTERN

VIDE-V27803 / DRUCK: 5

CONDUCTOR VIEW OF POWER BOARD

POWER BOARD

(COMPONENT SIDE VIEW)



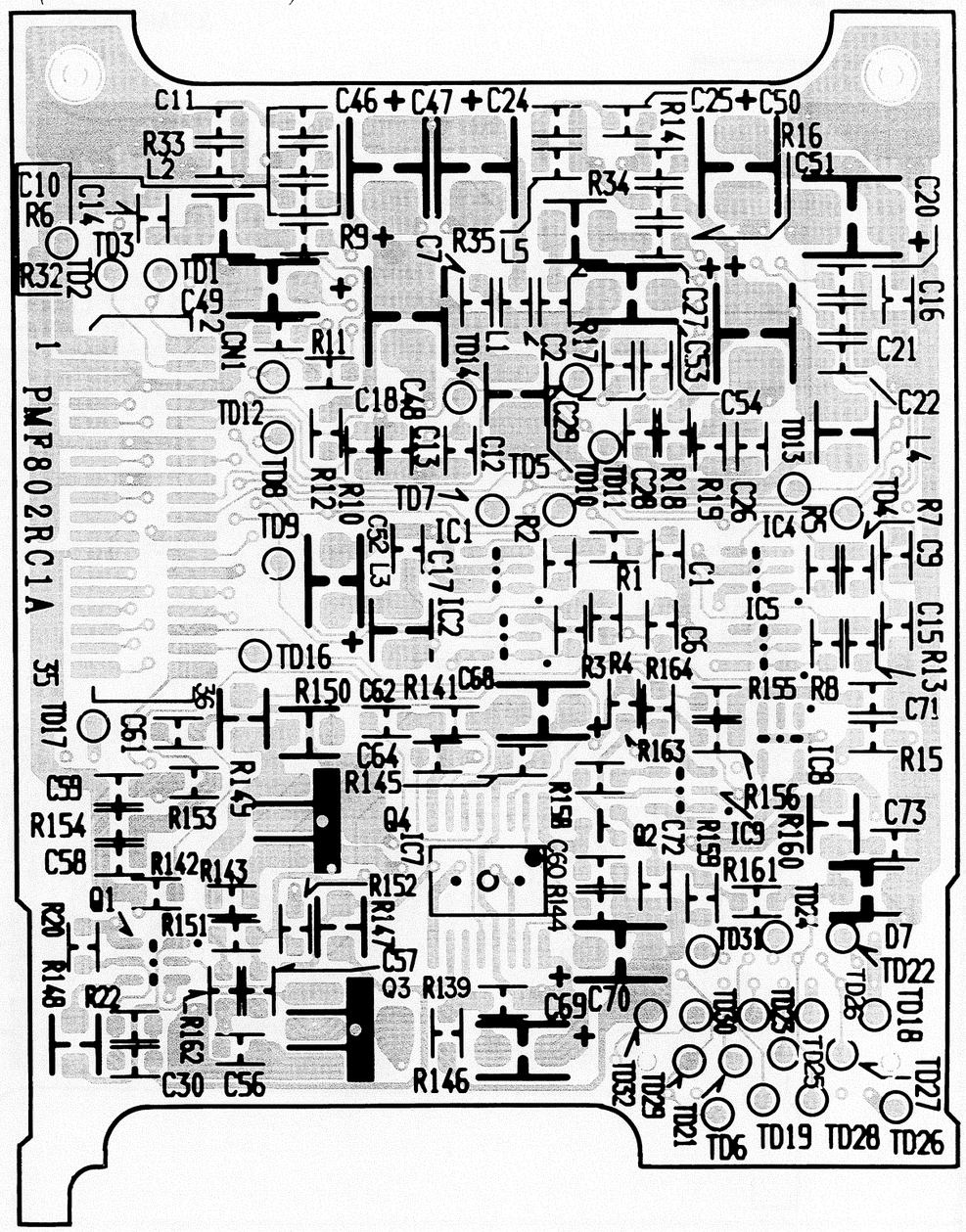
<INDEX>

POWER BOARD

IC3	D3	Q1	B4
IC6	D1	Q2	B6
IC7	B5	Q3	B5
IC8	B6	Q4	B5
IC9	B5		
		D5	B3
		D6	C2
		D7	B6

COMPONENT SIDE

(PATTERN SIDE VIEW)

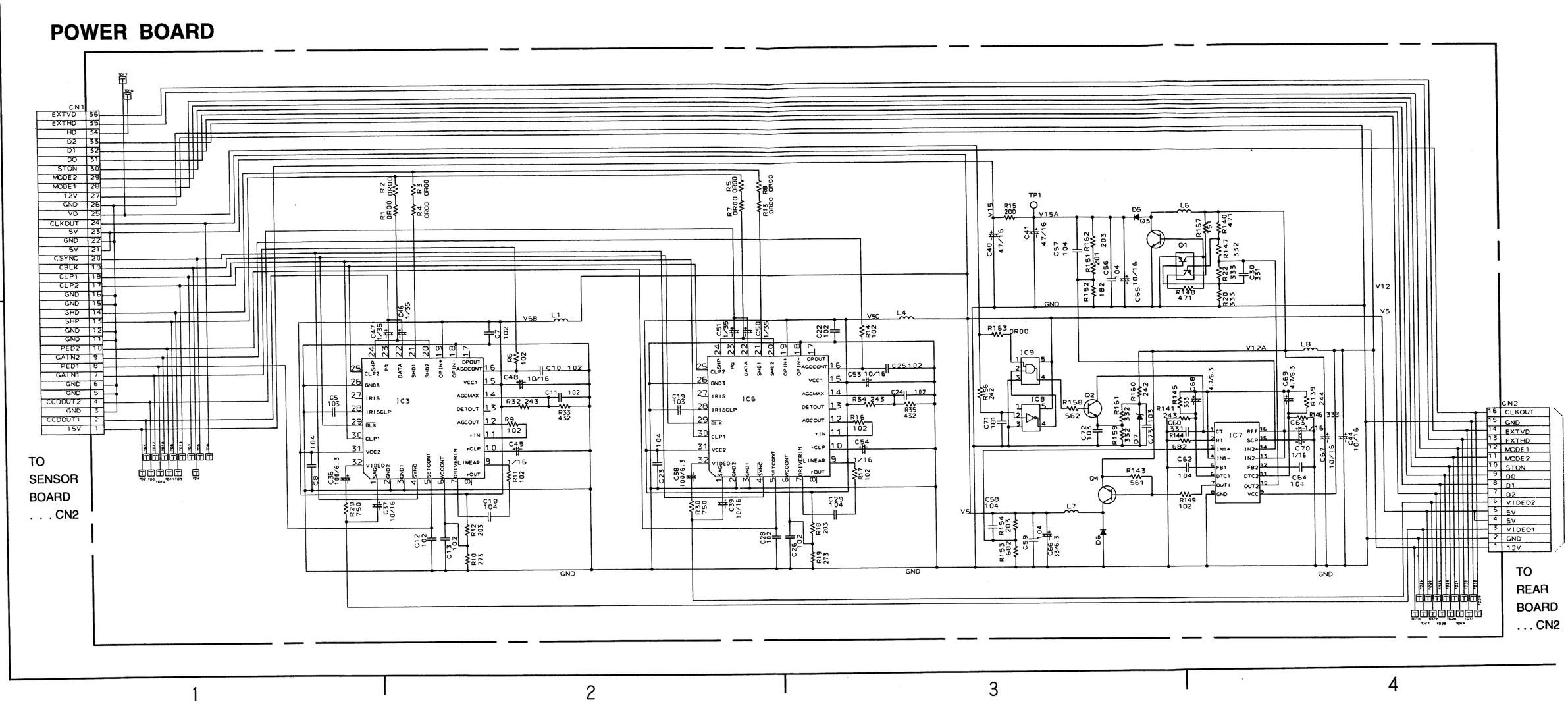


PATTERN SIDE

INTERMEDIATE PATTERN

SCHEMATIC DIAGRAM OF POWER BOARD

POWER BOARD



<Index>

POWER BOARD

IC3	A2	Q1	B3
IC6	A3	Q2	A3
IC7	A4	Q3	B3
IC8	A3	Q4	A3
IC9	A3		
		D5	B3
		D6	A3
		D7	A3

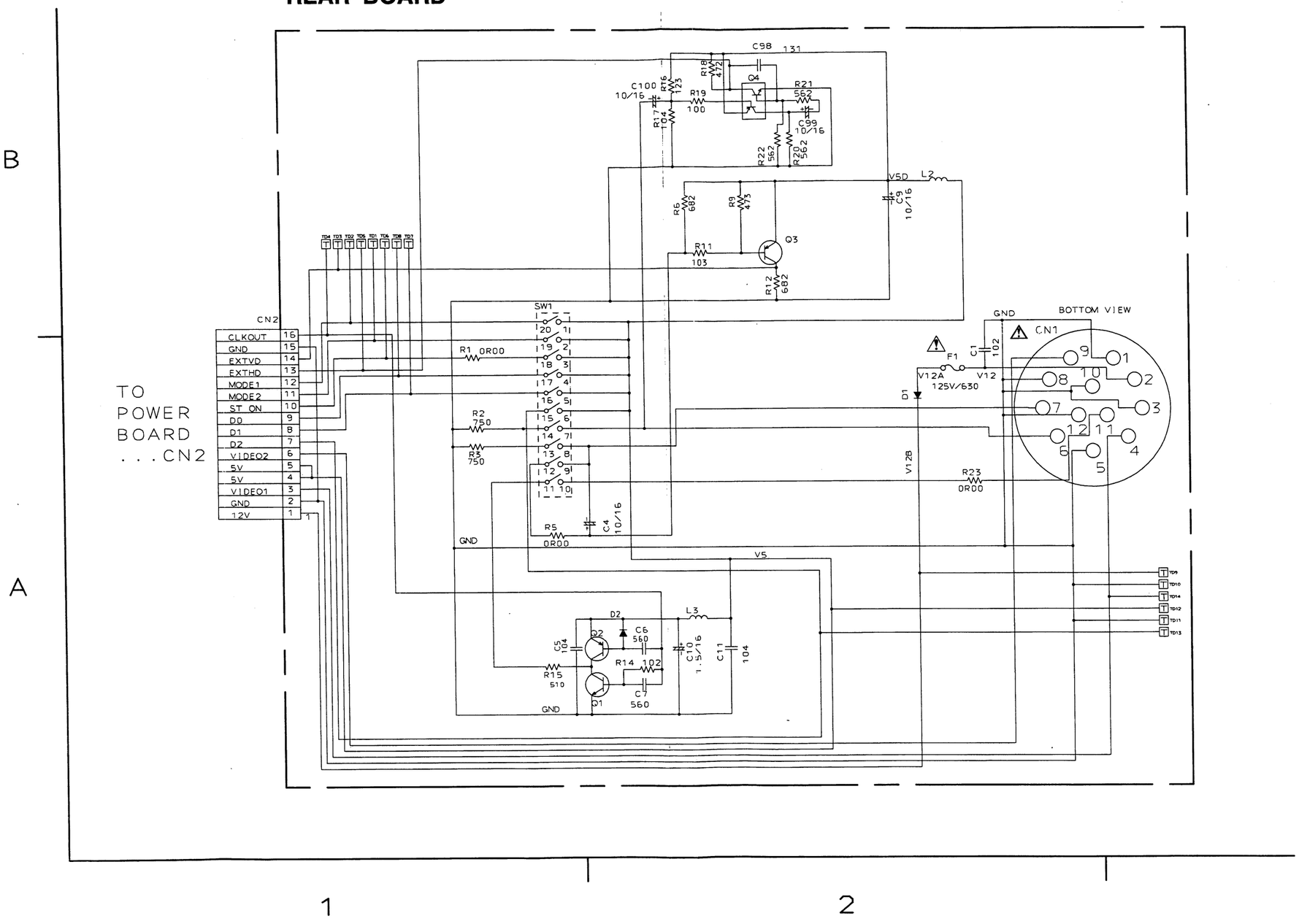
VIDE-V27803 / DRUCK: 7

SCHEMATIC DIAGRAM OF REAR BOARD

REAR BOARD

<Index>
REAR BOARD
Q1 A2
Q2 A2
Q3 B2
Q4 B2

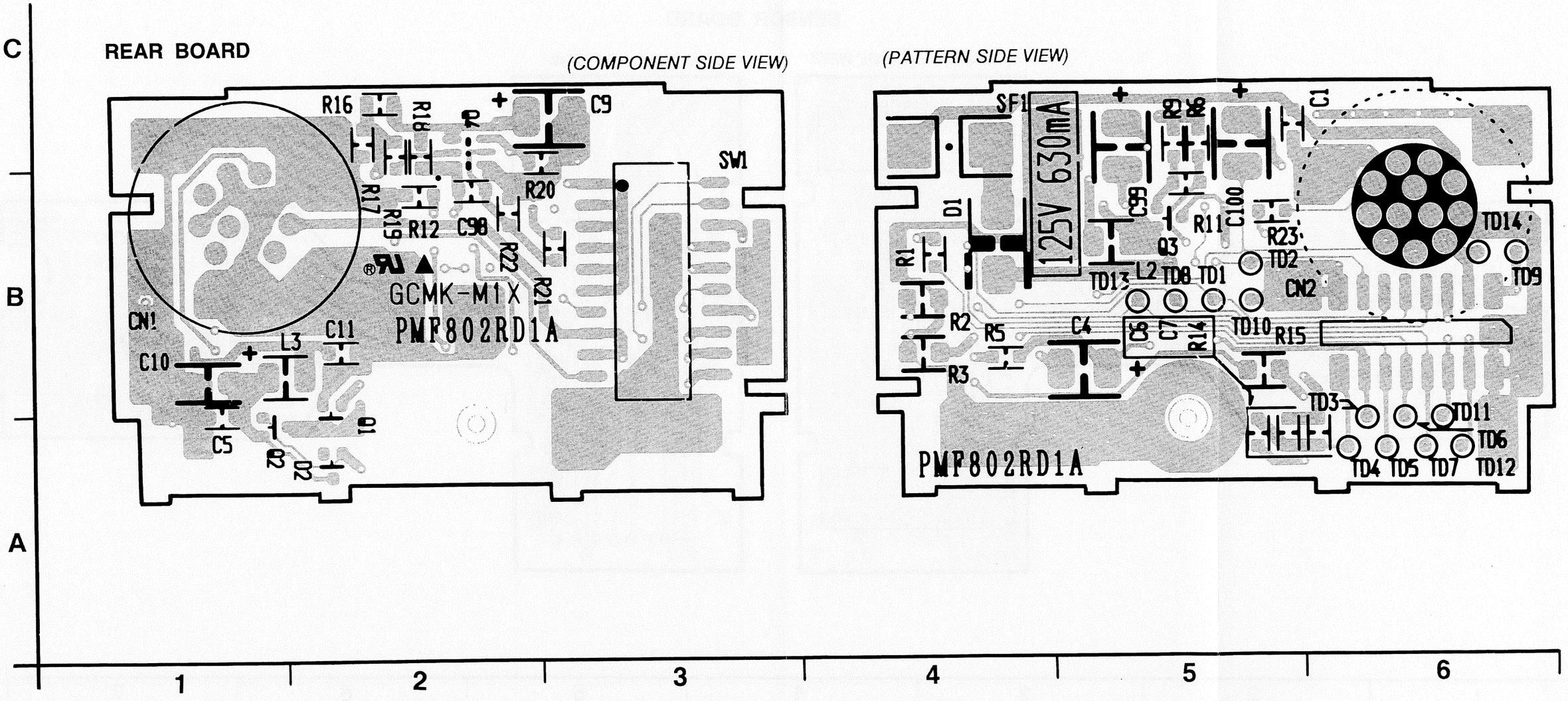
D1 A2
D2 A2



Important safety notice
Components identified by * ⚠ * mark have special characteristics for safety.
When replacing any of these components, use only manufacturer's specified parts.

CONDUCTOR VIEW OF REAR BOARD

REAR BOARD *(COMPONENT SIDE VIEW)* *(PATTERN SIDE VIEW)*



<Index>

REAR BOARD

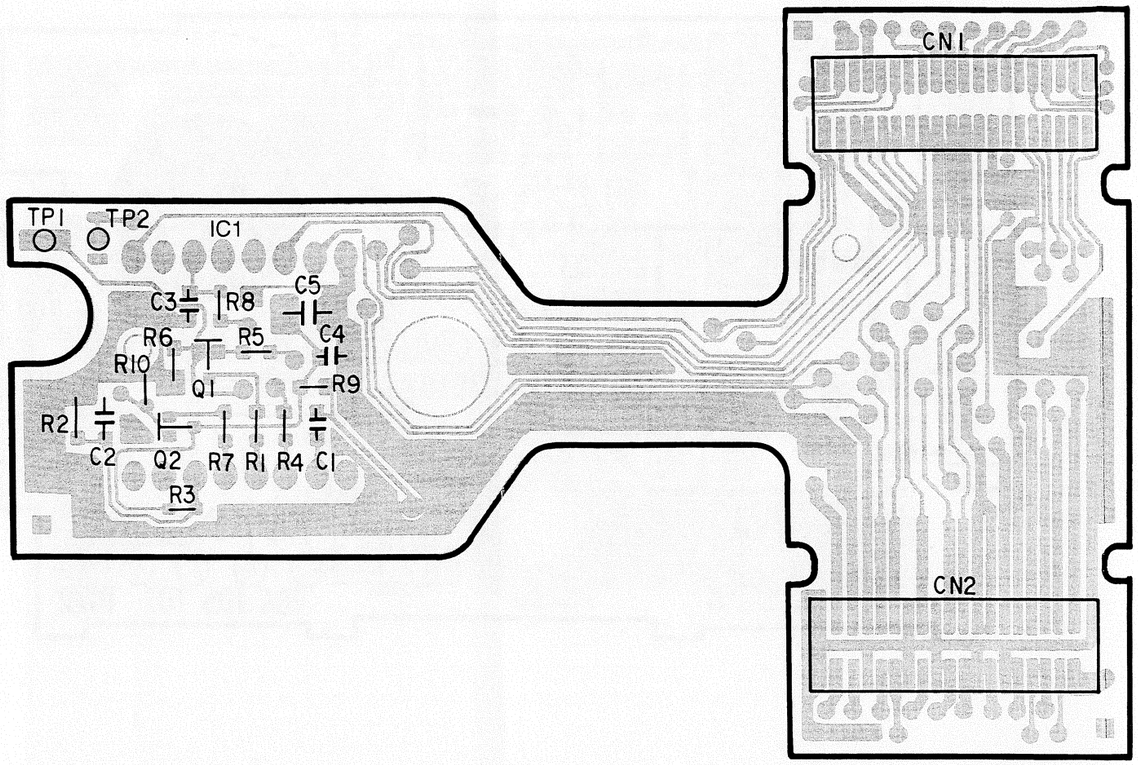
Q1	A2
Q2	A1
Q3	B5
Q4	C2
D1	B4
D2	A2

VIDE-V27803 / DRUCK: 9

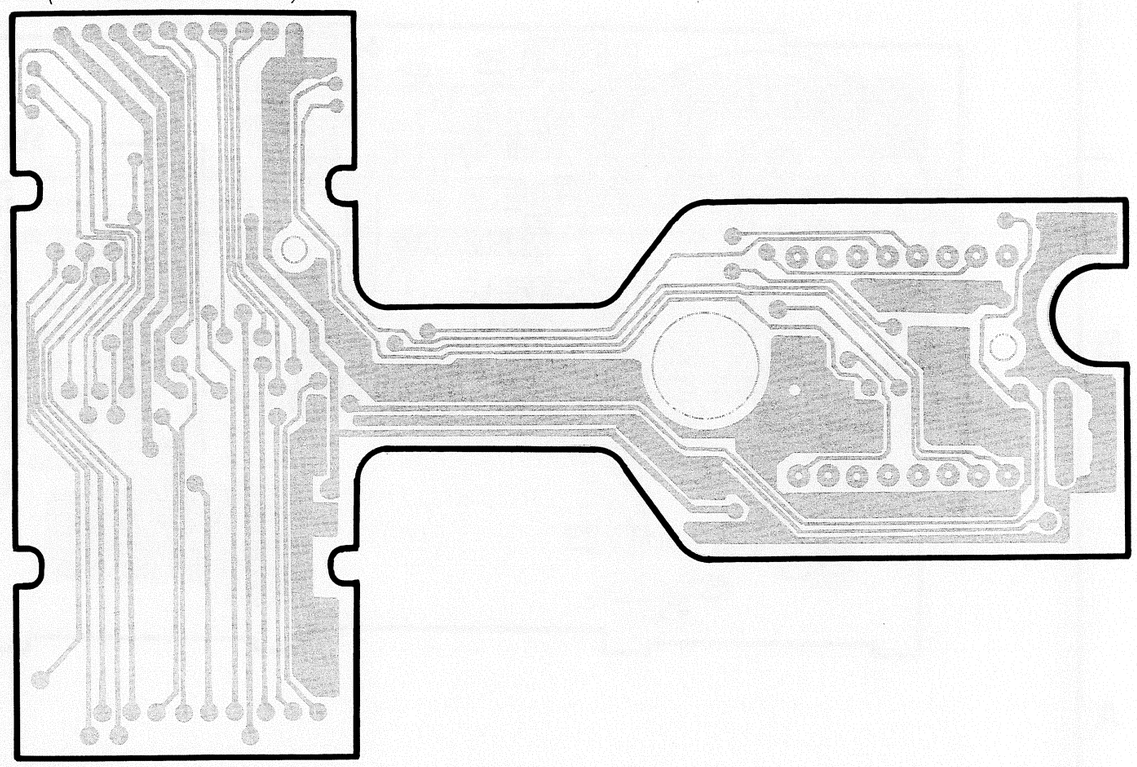
CONDUCTOR VIEW OF SENSOR BOARD

SENSOR BOARD

(COMPONENT SIDE VIEW)



(PATTERN SIDE VIEW)



C
B
A
1 2 3 4 5 6 7

<Index>

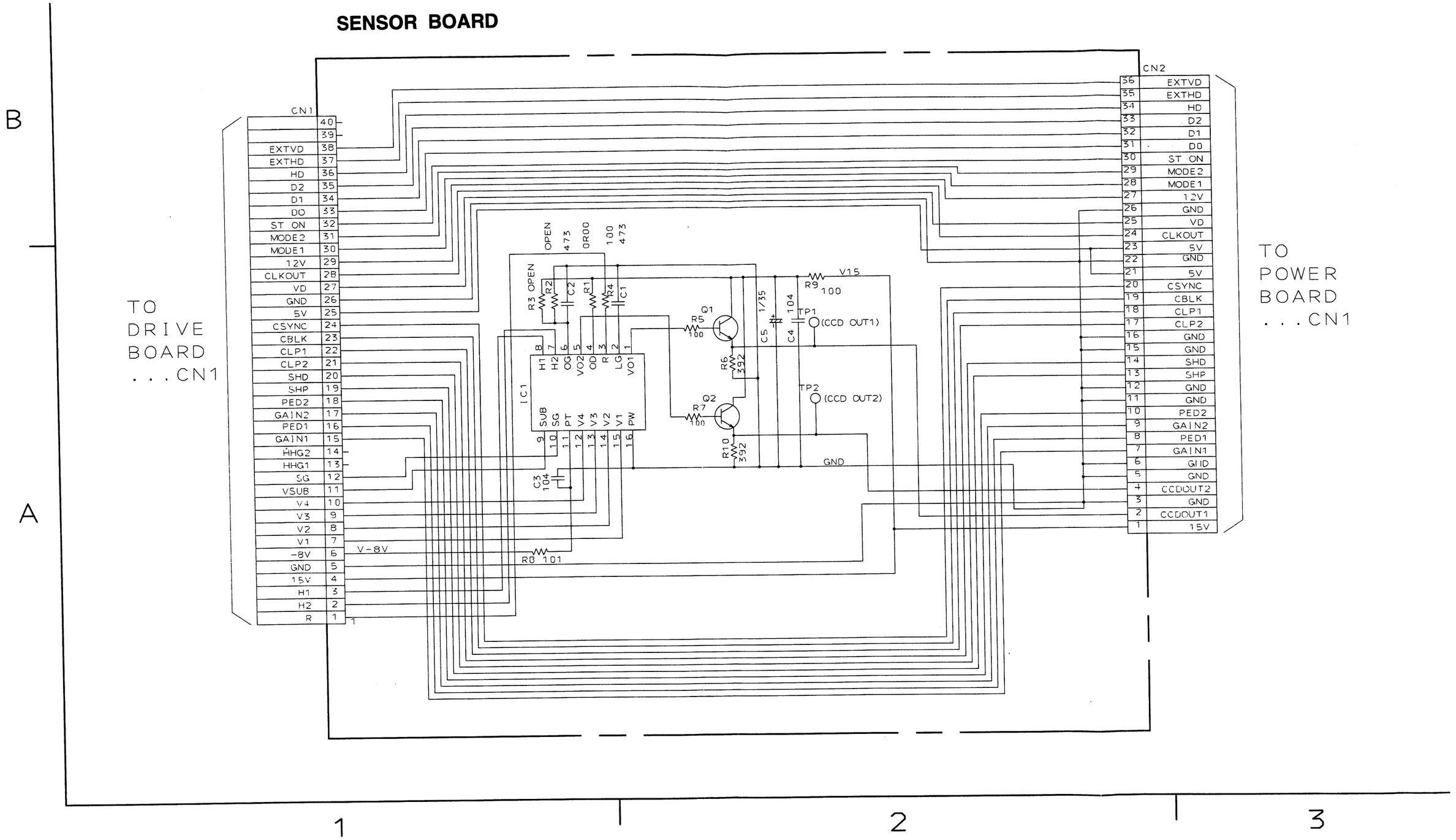
SENSOR BOARD

IC1	B1
Q1	B1
Q2	B1

VIDE-V27803 / DRUCK: 10

SCHEMATIC DIAGRAM OF SENSOR BOARD

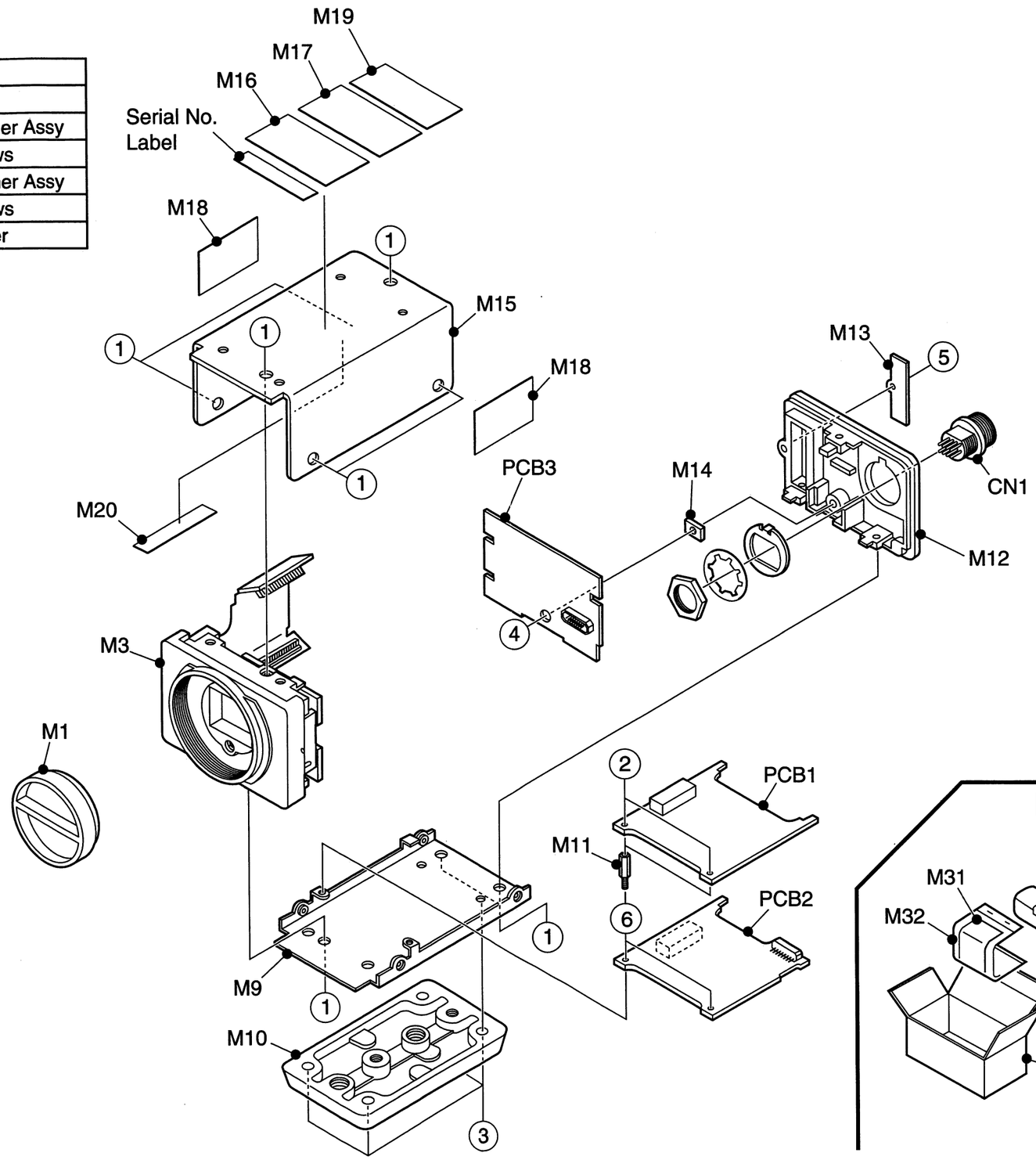
SENSOR BOARD



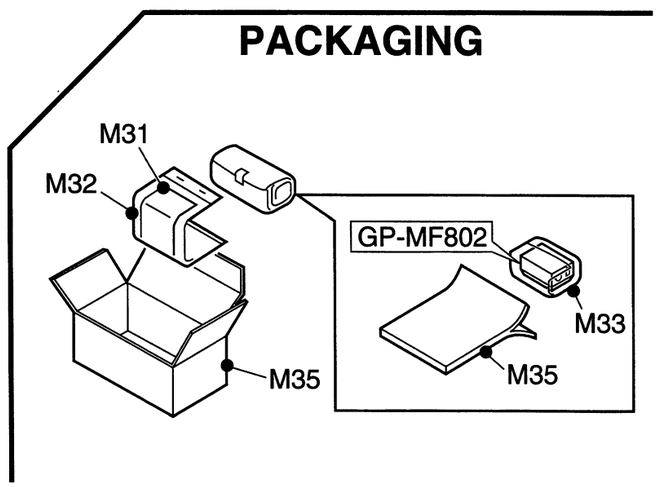
EXPLODED VIEW

◯ Numbers show screws, washers and etc.

No.	Screws	Description
①	XSS2+4FXK	Flush Head Black Screws
②	XYN2+J5FN	Machine Screw and Washer Assy
③	XSB2+8FXK	Binding Head Black Screws
④	XYN2+F8FN	Machine Screw and Washer Assy
⑤	XSB2+4FXK	Binding Head Black Screws
⑥	XWE2FN	Small Round Plain Washer



PACKAGING



VIDE-V27803 / DRUCK: 12

REPLACEMENT PARTS LIST

Important Notice

1. Components identified by " ⚠ " mark have special characteristics important for safety.
   When replacing any of these components, use only manufacturer's specified parts.
2. RTL : Retention Time Limited.

REF.NO.	PART NO.	DESCRIPTION
MISCELLANEOUS		
M1	YWBC-2B	Body Cap
M9	YWV5EA2136A3	Bottom Cover
M10	YWV2TB0131A3	Mounting Bracket
M11	YWBSB2010	Special Screw
M13	YWV6EA0206A4	Rear Blank Cover
M15	YWV5EA2135A3	Upper Cover
M16 ⚠	YWV7QA4480A4	Main Label
M17 ⚠	YWV7MB0061A4	FCC Label
M18 ⚠	YWV7QA4481A4	Model Side Label
M19 ⚠	YWV7MA1032A4	UL Caution Label
M20 ⚠	YWV7MA0270A4	Fuse Change Label
113	YWPMF802A02	

REF.NO.	PART NO.	DESCRIPTION	
DRIVE BOARD			
PCB1 (RTL)	YWPMF802KB1A	Printed Circuit Board Assy	
IC5	YWBU121070A	CustomIC	
IC6	MN3112SA	IC	
IC7	YW78L09UATE2	IC	
IC8	YWTC7S08FUL	IC	
IC10	YWTC4W53FUL	IC	
IC12,13	YWTC7S04FUL	IC	
Q1	2SK662-PQR	FET	
Q2,3	UMZ1	Transistor	
Q7	2SC4617	Transistor	
Q12	2SA1774	Transistor	
Q13	2SC4617	Transistor	
D1,2	MA729	Diode	
D3,7	MA132K	Diode	
D8	MA132K	Diode	
D9,10	YWDA227TL	Diode	
D11,12	MA372	Diode	
D13	YWDA223TL	Diode	
R1	ERJ3GEYJ562	Carbon	5.6K ohms 1/16W
R7	ERJ3GEYJ221	Carbon	220 ohms 1/16W
R11	ERJ3GEYJ103	Carbon	10K ohms 1/16W
R12,13	ERJ3GEYJ100	Carbon	10 ohms 1/16W
R14	ERJ3GEYJ561	Carbon	560 ohms 1/16W
R17	ERJ3GEYJ103	Carbon	10K ohms 1/16W
R20	ERJ3GEYJ392	Carbon	3.9K ohms 1/16W
R22	ERJ3GEYJ203	Carbon	20K ohms 1/16W
R23	ERJ3GEYJ273	Carbon	27K ohms 1/16W
R24	ERJ3GEYJ153	Carbon	15K ohms 1/16W
R25	ERJ3GEY0R00	Carbon	0 ohms 1/16W
R26	ERJ3GEYJ392	Carbon	3.9K ohms 1/16W
R27	ERJ3GEYJ203	Carbon	20K ohms 1/16W
R28	ERJ3GEYJ273	Carbon	27K ohms 1/16W
R29	ERJ3GEYJ105	Carbon	1M ohms 1/16W
R30	ERJ3GEY0R00	Carbon	0 ohms 1/16W
R31	ERJ3GEYJ105	Carbon	1M ohms 1/16W
R32	ERJ3GEYJ153	Carbon	15K ohms 1/16W
R33,34	ERJ3GEYJ222	Carbon	2.2K ohms 1/16W
R35,36	ERJ3GEYJ103	Carbon	10K ohms 1/16W
R37	ERJ3GEYJ222	Carbon	2.2K ohms 1/16W
R38	ERJ3GEYJ392	Carbon	3.9K ohms 1/16W
R39	ERJ3GEYJ562	Carbon	5.6K ohms 1/16W
R40	ERJ3GEYJ332	Carbon	3.3K ohms 1/16W
R41	ERJ3GEYJ752	Carbon	7.5K ohms 1/16W
R42	ERJ3GEYJ222	Carbon	2.2K ohms 1/16W
R43	ERJ3GEYJ123	Carbon	12K ohms 1/16W
R44,45	ERJ3GEYJ102	Carbon	1K ohms 1/16W

REF.NO.	PART NO.	DESCRIPTION
R46	ERJ3GEYJ104	Carbon 100K ohms 1/16W
R47	ERJ3GEYJ100	Carbon 10 ohms 1/16W
R48	ERJ3GEYJ331	Carbon 330 ohms 1/16W
R49	ERJ3GEYJ102	Carbon 1K ohms 1/16W
R52	ERJ3GEYJ182	Carbon 1.8K ohms 1/16W
R53	ERJ3GEYJ103	Carbon 10K ohms 1/16W
R55	ERJ3GEYJ821	Carbon 820 ohms 1/16W
R57	ERJ3GEYJ471	Carbon 470 ohms 1/16W
R58	ERJ3GEYJ104	Carbon 100K ohms 1/16W
R59-64	ERJ3GEYJ103	Carbon 10K ohms 1/16W
R65-67	ERJ3GEYJ100	Carbon 10 ohms 1/16W
R69	ERJ3GEYJ103	Carbon 10K ohms 1/16W
R70	ERJ3GEYJ562	Carbon 5.6K ohms 1/16W
R71	ERJ3GEYJ752	Carbon 7.5K ohms 1/16W
R73	ERJ3GEYJ103	Carbon 10K ohms 1/16W
R74	ERJ3GEYJ473	Carbon 47K ohms 1/16W
R75,77	ERJ3GEY0R00	Carbon 0 ohms 1/16W
R79,82	ERJ3GEY0R00	Carbon 0 ohms 1/16W
VR1-5	EVM7JGA30B14	Variable Resistor 10K ohms
VR6,7	EVM7JGA30B24	Variable Resistor 20K ohms
C2	YW5X682K2VB	Ceramic 6800 pF
C3,8	YW5X102K5VB	Ceramic 1000 pF
C13	YW5CH510J5VB	Ceramic 51 pF
C15	YW5CH100D5VB	Ceramic 10 pF
C17,18	YW5F104Z2VB	Ceramic 0.1 µF
C19,20	YW5X102K5VB	Ceramic 1000 pF
C22	YW5F104Z2VB	Ceramic 0.1 µF
C23	YW5X102K5VB	Ceramic 1000 pF
C24,25	YW5F104Z2VB	Ceramic 0.1 µF
C26	YW5CH070C5VB	Ceramic 7 pF
C27	YW5CH331J5VB	Ceramic 330 pF
C28	YW5CH070C5VB	Ceramic 7 pF
C29	YW5F104Z2VB	Ceramic 0.1 µF
C31	YW5CH470J5VB	Ceramic 47 pF
C32	YW5CH331J5VB	Ceramic 330 pF
C33	YW5CH470J5VB	Ceramic 47 pF
C34	YW5F104Z2VB	Ceramic 0.1 µF
C35	YW5X392K5VB	Ceramic 3900 pF
C36	YW5CH100D5VB	Ceramic 10 pF
C37	YW5X102K5VB	Ceramic 1000 pF
C38	YW5F104Z2VB	Ceramic 0.1 µF
C39,40	YW426105XK	Ceramic 1 µF
C41	YW5F104Z2VB	Ceramic 0.1 µF
C43,44	YW5X102K5VB	Ceramic 1000 pF
C46,47	YW426105XK	Ceramic
C48	YF400224FZT	Ceramic 0.22 µF
C49	ECEV1EG6R8GR	Electrolytic 6.8 µF 25V
C50	ECEV1CG100GR	Electrolytic 10 µF 16V
C51	ECEV1HG3R3GR	Electrolytic 3.3 µF 16V
C52	ECEV1CG100GR	Electrolytic 10 µF 16V
C53	ECEV1CG470GP	Electrolytic 47 µF 16V
C56,57	ECST1CX106ZR	Electrolytic 10 µF 16V
C58	TAJA105M016	Electrolytic 1 µF 16V
C59	YW5F104Z2VB	Ceramic 0.1 µF
C60	EEVHA1C100R	Electrolytic

REF.NO.	PART NO.	DESCRIPTION
CF2-4	YWBLM31A02PT	Coil
CF7	YWBLM31A02PT	Coil
L1	EQC4EJ016E	Coil
L6	ELJSC470KB	Coil
X1	YW840G24R545	Crystal Oscillator
CN1	YW533074091	Connector
TP1,3	YWRCT2125TPV	Test Point
TP4-6	YWRCT2125TPV	Test Point

POWER BOARD

PCB2 (RTL)	YWPMF802KC1A	Printed Circuit Board Assy
IC3,6	YWCXA1310AQ	IC
IC7	YWMB3775PFV	IC
IC8	YWTC7S04FUL	IC
IC9	YWTC7S08FUL	IC
Q1	UMZ1	Transistor
Q2	2SC4617	Transistor
Q3	2SD874A-RS	Transistor
Q4	2SB766A-QR	Transistor
D5,6	YWSC80206L	Diode
D7	YWMA8024TX	Diode
R1-5	ERJ3GEY0R00	Carbon 0 ohms 1/16W
R6	ERJ3GEYJ102	Carbon 1K ohms 1/16W
R7,8	ERJ3GEY0R00	Carbon 0 ohms 1/16W
R9	ERJ3GEYJ102	Carbon 1K ohms 1/16W
R10	ERJ3RHD273	Metal 27K ohms 1/16W
R11	ERJ3GEYJ102	Carbon 1K ohms 1/16W
R12	ERJ3RHD203V	Metal 20K ohms 1/16W
R13	ERJ3GEY0R00	Carbon 0 ohms 1/16W
R14	ERJ3GEYJ102	Carbon 1K ohms 1/16W
R15	ERJ3GEYJ200	Carbon 20 ohms 1/16W
R16,17	ERJ3GEYJ102	Carbon 1K ohms 1/16W
R18	ERJ3RHD203V	Metal 20K ohms 1/16W
R19	ERJ3RHD273	Metal 27K ohms 1/16W
R20,22	ERJ3GEYJ333	Carbon 33K ohms 1/16W
R29,30	YWR1220Q750D	Metal 75 ohms
R32	ERJ3RHD243V	Metal 24K ohms 1/16W
R33	ERJ3RHD432V	Metal 4.3K ohms 1/16W
R34	ERJ3RHD243V	Metal 24K ohms 1/16W
R35	ERJ3RHD432V	Metal 4.3K ohms 1/16W
R139	ERJ3GEYJ244	Carbon 240K ohms 1/16W
R140	ERJ3GEYJ471	Carbon 470 ohms 1/16W
R141	ERJ3GEYJ243	Carbon 24K ohms 1/16W
R143	ERJ3GEYJ561	Carbon 560 ohms 1/16W
R144	ERJ3GEYJ682	Carbon 6.8K ohms 1/16W
R145,146	ERJ3GEYJ333	Carbon 33K ohms 1/16W
R147	ERJ6GEYJ332	Carbon 3.3K ohms 1/16W
R148	ERJ6GEYJ471	Carbon 470 ohms 1/16W
R149	ERJ6GEYJ102	Carbon 1K ohms 1/10W
R151	ERJ3RHD201V	Metal 200 ohms 1/16W
R152	ERJ3RHD182V	Metal 1.8K ohms 1/16W

REF.NO.	PART NO.	DESCRIPTION	
R153	ERJ3RHD682V	Metal	6.8K ohms 1/16W
R154	ERJ3RHD203V	Metal	20K ohms 1/16W
R156	ERJ3RHD242V	Metal	2.4K ohms 1/16W
R157	ERJ3GEYJ151	Carbon	150 ohms 1/16W
R158	ERJ3GEYJ562	Carbon	5.6K ohms 1/16W
R159	ERJ3GEYJ332	Carbon	3.3K ohms 1/16W
R160	ERJ6GEYJ242	Carbon	2.4K ohms 1/16W
R161	ERJ3GEYJ332	Carbon	3.3K ohms 1/16W
R162	ERJ3RHD203V	Metal	20K ohms 1/16W
R163	ERJ3GEY0R00	Carbon	0 ohms 1/16W
C5	YW5X103K5VB	Ceramic	0.01 µF
C7	YW5X102K5VB	Ceramic	1000 pF
C8	YW5F104Z2VB	Ceramic	0.1 µF
C10-13	YW5X102K5VB	Ceramic	1000 pF
C18	YW5F104Z2VB	Ceramic	0.1 µF
C19	YW5X103K5VB	Ceramic	0.01 µF
C22	YW5X102K5VB	Ceramic	1000 pF
C23	YW5F104Z2VB	Ceramic	0.1 µF
C24-26	YW5X102K5VB	Ceramic	1000 pF
C28	YW5X102K5VB	Ceramic	1000 pF
C29	YW5F104Z2VB	Ceramic	0.1 µF
C30	YW5CH331J5VB	Ceramic	330 pF
C36	ECEV0JG101GP	Electrolytic	100 µF 6.3V
C37	ECEV1CG100GR	Electrolytic	10 µF 16V
C38	ECEV0JG101GP	Electrolytic	100 µF 6.3V
C39	ECEV1CG100GR	Electrolytic	100 µF 16V
C40,41	EEVHA1C470P	Electrolytic	47 µF 16V
C44	ECGC1CB100R	Electrolytic	10 µF 16V
C46,47	ECST1VX105ZR	Tantalum	1 µF 35V
C48	ECST1CX106ZR	Tantalum	10 µF 16V
C49	TAJA105M016	Electrolytic	1 µF 16V
C50,51	ECST1VX105ZR	Tantalum	1 µF 35V
C53	ECST1CX106ZR	Tantalum	10 µF 16V
C54	TAJA105M016	Tantalum	1 µF 16V
C56-59	YW5F104Z2VB	Ceramic	0.1 µF
C60	YW5CH331J5VB	Ceramic	330 pF
C62	YW5F104Z2VB	Ceramic	0.1 µF
C63	TAJA105M016	Tantalum	1 µF 16V
C64	YW5F104Z2VB	Ceramic	0.1 µF
C65	ECGC1CB100R	Electrolytic	1 µF 16V
C66	ECGC0JB330R	Semiconductor	33 µF 6.3V
C67	ECGC1CB100R	Electrolytic	10 µF 16V
C68,69	ECST0JY475	Electrolytic	4.7 µF 6.3V
C70	TAJA105M016	Electrolytic	1 µF 16V
C71	YW5CH181J5VB	Ceramic	180 pF
C72,73	YW5X103K5VB	Ceramic	0.01 µF
L1,4	ELJFC8R2MF	Coil	8.2 µH
L6	YWCDR74221MC	Coil	220 µH
L7,8	YWCDR63101KC	Coil	100 µH
CN1	YW533073691	Connector	
CN2	YW41756396	Connector	
TP1	YWRCT2125TPV	Test-Pin	

REF.NO.	PART NO.	DESCRIPTION	
REAR BOARD			
PCB3 (RTL)	YWPMF802KD1A	Printed Circuit Board Assy	
Q1	2SC4691	Transistor	
Q2	2SA1806	Transistor	
Q3	2SA1774	Transistor	
Q4	UMZ1	Transistor	
D1	YWSC2114L	Diode	
D2	MA132K	Diode	
R1	ERJ3GEY0R00	Carbon	0 ohms 1/16W
R2,3	ERJ6GEYJ750	Carbon	75 ohms 1/10W
R5	ERJ3GEY0R00	Carbon	0 ohms 1/16W
R6	ERJ3GEYJ682	Carbon	6.8K ohms 1/16W
R9	ERJ3GEYJ473	Carbon	47K ohms 1/16W
R11	ERJ3GEYJ103	Carbon	10K ohms 1/16W
R12	ERJ3GEYJ682	Carbon	6.8K ohms 1/16W
R14	ERJ3GEYJ102	Carbon	1K ohms 1/16W
R15	ERJ6GEYJ510	Carbon	51 ohms 1/10W
R16	ERJ3GEYJ123	Carbon	12K ohms 1/16W
R17	ERJ3GEYJ104	Carbon	100K ohms 1/16W
R18	ERJ3GEYJ472	Carbon	4.7K ohms 1/16W
R19	ERJ3GEYJ100	Carbon	10 ohms 1/16W
R20-22	ERJ3GEYJ562	Carbon	5.6K ohms 1/16W
R23	ERJ3GEY0R00	Carbon	0 ohms 1/16W
C1	YW5X102K5VB	Ceramic	1000 pF
C4	ECST1CX106ZR	Tantalum	10 µF 16V
C5	YW5F104Z2VB	Ceramic	0.1 µF
C6,7	YW5CH560J5VB	Ceramic	56 pF
C9	ECST1CX106ZR	Tantalum	10 µF 16V
C10	ECST1CY155	Tantalum	1.5 µF 16V
C11	YW5F104Z2VB	Ceramic	0.1 µF
C98	YW5CH131J5VB	Ceramic	130 pF
C99,100	ECST1CX106ZR	Tantalum	10 µF 16V
L2	ELJSC560K	Coil	56 µH
L3	ELJFC8R2MF	Coil	8.2 µH
SW1	YWCHS10TB	Slide Switch	
F1 ⚠	YWSSFC0R63	Current Fuse	0.63A
CN1 ⚠	HR10A10R12PB	Connector	
CN2	YW41756356	Connector	
M12	YWV5BA0136A3	Rear Escutcheon	
M14	YWV2NA1038A4	Spacer	
ACCESSORY PARTS/PACKAGING PARTS			
M31 ⚠	YWV8QA4489AN	Operating Instructions	
M32	YWT20X35C03	Polyethylene Bag	
M33	YWT15X20C03	Polyethylene Bag	
M35	YWV9CA3409AN	Packaging Assy	